SUPPLEMENTAL COMMENTS OF INTERNATIONAL PAPER COMPANY (IP) AND MCGINNES INDUSTRIAL MAINTENANCE CORPORATION (MIMC) ON THE REMEDIAL ALTERNATIVES FOR THE SAN JACINTO RIVER SUPERFUND SITE (SITE)

IP and MIMC (Respondents) respectfully supplement their prior June 20, 2014 comments (June 2014 Comments) regarding the remedy for the northern area of the Site (Northern Impoundments). In the 23 months since submission of the June 2014 Comments, developments have occurred and additional information has become available that further support the selection of the existing armored cap, as strengthened and made permanent by adding additional armoring, further flattening its slopes, and implementing measures to protect it from vessel traffic (Alternative 3N of the Draft Interim Final Feasibility Study (FS)) as the preferred alternative for the Northern Impoundments.[1] Those developments and new information are discussed below.

Background

In 2011, the Northern Impoundments were the subject of a $9 million time critical removal action (TCRA) to completely isolate all material in the Northern Impoundments under an engineered armored cap (Armored Cap). Constructed in 1965, the Northern Impoundments were used only for the disposal of paper mill waste (a highly fibrous, dense material with a very low permeability of 10^{-6} to 10^{-7} cm/sec.) from September 1965 until May 1966. A waste fingerprint analysis demonstrated that prior to construction of the Armored Cap in 2011, dioxin associated with the paper mill waste had largely remained within the original perimeter of the Northern Impoundments; the only significant movement of waste had occurred north and west of the impoundments (upgradient) where waste had apparently been physically dredged from the impoundments by a sand dredging operation. (Integral Consulting and Anchor QEA 2013, Sections 5.1 and 5.7.4.1).

The Armored Cap was constructed using stone as armor, geotextile and geomembrane and was designed to United States Army Corps of Engineer (USACE) standards to withstand 100-year storm and 500-year flood events, including events such as the October 1994 flood (a 50 to 100-year flood), Hurricane Ike (a 2-year flood) and Tropical Storm Allison (a 5-year flood). It was enhanced in January 2014 by flattening some slopes and adding larger rock to implement USACE recommendations that resulted in a "no movement" design under USACE's cap design criteria. Under Alternative 3N, the Armored Cap would be further strengthened and made permanent by adding additional armoring, further flattening submerged slopes (from 2 horizontal to 1 vertical (2H:1V) to 3H:1V), and implementing measures to protect it from vessel traffic (Permanent Cap). The Permanent Cap (Alternative 3N) uses a 1.5 factor of safety for sizing the armor stone, a more conservative approach than was used for the original Armored Cap design and for other CERCLA caps, such as those at the Onondaga Lake and Fox River sites (Anchor QEA 2014, Appendix B).

Four groundwater monitoring wells were installed through and adjacent to the Northern Impoundments as part of the Site investigation. Samples from those wells showed no detection of dioxins, confirming that dioxins had not migrated from the Northern Impoundments into the surrounding environment during their over four decades of existence (without a cap).

After the Armored Cap was in place, Dr. Danny Reible of Texas Tech University conducted a porewater study that demonstrated that no detectible levels of dioxins were migrating from the Northern Impoundments into the porewater above the Armored Cap. Dr. Reible is a noted capping expert who also

[1] No additional comments are being provided regarding the remedy for the Site investigation area located south of Interstate 10 (the Southern Area), and references in these supplemental comments to the remedy for the "Site" refer to the remedy for the Northern Impoundments.

completed a peer review of the Armored Cap in which he concluded that the Armored Cap is appropriate and protective to address Site conditions and will be effective into the future. Dr. Reible also reviewed the various alternatives in the FS and determined that Alternative 3N provides the best alternative. His report is included as part of Respondents' June 2014 Comments. Respondents' June 2014 Comments are provided as part of these supplemental comments as Appendix A.[2]

Summary of Developments and New Information Since the June 2014 Comments Relevant to Remedy Selection

The developments and new information are detailed below and include the following:

- In 2015, the USACE issued its draft technical assessment of the remedial alternatives for the Northern Impoundments titled, *Evaluation of the San Jacinto Waste Pits Feasibility Study Remediation Alternatives* (USACE Report [USACE, 2015]). As discussed below, the USACE Report concludes that the Permanent Cap is expected to be "highly effective." *See* discussion below at I.A (pp. 4-5).

- The Armored Cap continues to perform as designed and consistent with USEPA guidance, adding to the evidence demonstrating its continued protectiveness. Since June 2014, several significant high water events have occurred in the San Jacinto River, including a 10 to 20-year flood during April 2016 (USGS, 2016), with no observed adverse effect on the Armored Cap. *See* discussion below at I.B (pp. 5-6).

- The Armored Cap has undergone an additional two years of operation and maintenance (O&M), during which there were three maintenance events within the scope of the USEPA-approved TCRA Operations, Monitoring and Maintenance Plan (OMM Plan). These maintenance events were of the kind contemplated by USEPA guidance on capping (USEPA 2005, Highlight 5-4 ("Maintenance of in-situ caps is expected periodically")). In each of the maintenance events, maintenance was conducted quickly and efficiently by Respondents' contractor, with no loss of material from beneath the Armored Cap. *See* discussion below at I.C (p. 6).

- USEPA has asked the USACE to develop an additional removal alternative for the Northern Impoundments in which excavation of the waste material would, to the extent feasible, be conducted "in the dry" (Additional Removal Alternative). Region 6 has not provided Respondents with the elements of the Additional Removal Alternative in any detail, or provided a projected schedule or cost estimate for it, and as a result, the Additional Removal Alternative should not even be considered by the Board. Given what little is known about the Additional Removal Alternative, significant concerns exist as to the efficacy of any "in the dry" excavation in limiting disturbance and suspension of dioxin-impacted sediments during construction, as well as its implementability and cost. *See* discussion below at I.D (pp. 7-8).

- In March 2015, a report prepared by Dr. Kathleen Garland, on behalf of a local citizens group called Texans Together, was submitted to USEPA (Garland Report). The Garland Report discussed remedies selected at other sediment sites as a basis for arguing that USEPA has rejected capping alternatives at other sites and should do so at this Site. In fact, at many of the sites discussed in the Garland Report, USEPA selected capping as a component of the remedy. In cases where an excavation remedy was selected, the reasons for selecting excavation over

[2] The cover letter submitting the June 2014 Comments to USEPA, Appendix A of those comments (Response to Comments of Harris County) and the cover page to Appendix B of those comments, are not included with this submission due to page limitations.

capping relied upon factors that are not relevant to this Site (*e.g.*, planning for future navigation dredging in the remedy footprint). *See* discussion below at I.E (pp. 9).

Respondents request that the Board consider these developments and new information, as well as its June 2014 Comments (Appendix A), in undertaking a full and objective evaluation of the range of remedial alternatives for the Northern Impoundments.

Reasons Why the Board Should Select the Permanent Cap as the Preferred Remedy

The National Remedy Review Board (Board) was created in 1995 to "help control remedy costs and to promote both consistent and cost effective decisions at Superfund sites."[3] In creating the Board, USEPA emphasized that "cost plays an important role in Superfund response actions," and acknowledged CERCLA's mandate that "all remedies must be cost-effective."[4] In this case, the Board's review of the cost of the remedial alternatives is particularly important. The Additional Removal Alternative, for which a detailed cost-estimate has not been provided by USEPA or USACE, could cost significantly more than the $99.5 million estimated cost of the existing full removal alternative (Alternative 6N).

The relative costs of the alternatives were widely divergent in the FS (even before USEPA asked the USACE to develop the Additional Removal Alternative), yet the effectiveness and protectiveness of the Permanent Cap (Alternative 3N) was shown to be greater than the much more costly removal options. As noted in the June 2014 Comments, this Site presents a unique situation in which spending more will likely decrease the protectiveness and effectiveness of the remedy, while enhancing and maintaining the Armored Cap as a permanent remedy is the most effective means of permanently containing and isolating the wastes. In contrast, the sediment removal alternatives are likely to result in suspension and dispersal of the wastes (despite the use of best management practices (BMPs)) and could potentially cause increased fish tissue concentrations of dioxins and environmental releases - risks that cannot necessarily be avoided or minimized by removing the wastes "in the dry." Thus, an objective comparison of the remedial alternatives results in a clear conclusion that Alternative 3N (*i.e.*, enhancement of the Armored Cap) is the most environmentally protective, and at the same time, the most cost-effective remedial alternative. Selecting Alternative 3N would also fulfill the policy of the National Contingency Plan (NCP) that removal actions (*i.e.*, the construction of the Armored Cap during the TCRA) be consistent with the final remedy.

The June 2014 Comments also addressed why Alternative 3N ranks the highest in an analysis of the remedial alternatives under the NCP's nine criteria. June 2014 Comments at 18-20. In light of subsequent developments, it still does. Alternative 3N offers the greatest protectiveness, complies with all "applicable or relevant and appropriate requirements," incorporates a treatment component, is the most effective from both a short-term and long-term perspective, and is implementable, with no impacts to the flood capacity of the San Jacinto River. In that regard:

- Conversion of the Armored Cap into an even stronger Permanent Cap is consistent with CERCLA and the NCP.

- The Armored Cap has now been through five years of successful O&M, and with the additional enhancements contemplated by Alternative 3N, would withstand events greater than a 100-year storm and a 500-year flood.

[3] Memorandum from Elliot P. Laws, Assistant Administrator, Office of Solid Waste and Emergency Response, *Formation of National Remedy Review Board* (November 28, 1995) at 1.

[4] *Id*.

- USACE recommendations to strengthen the Armored Cap were implemented, and the Armored Cap was evaluated as "appropriate," "protective" and "effective" in the USACE Draft Report.

- Removal of the Armored Cap would be an unprecedented step and would unnecessarily create risks.[5]

- Removal of the Armored Cap would likely cause suspension and dispersal of sediment and an increase in fish tissue concentrations, and as discussed below, even if the work could be performed at least partially "in the dry" (under the Additional Removal Alternative), it would create the potential for disturbance and disbursement of the waste material during storm or flood conditions.

- Selection of Alternative 3N will minimize worker safety risks, environmental impacts from emissions, and other adverse community impacts.

- In addition to its environmental benefits, the Permanent Cap is the most cost-effective remedy, particularly when compared to the potential cost of the Additional Removal Alternative or of either Alternative 5N or 6N.

In summary, the Permanent Cap alternative presented in the FS, combined with the recently-installed additional security measures at the Site (*i.e.*, additional buoys and 24/7 remotely monitored security cameras), has a documented track record of effectiveness and is the preferred approach for providing a long-term protective remedy for the Northern Impoundments at the Site.

I. DEVELOPMENTS AND NEW INFORMATION RELEVANT TO REMEDY SELECTION

Below is a discussion of certain events that have occurred in the 23 months since the submission of the June 2014 Comments that are relevant to the Board's recommendation of a remedy. They are:

- The USACE published the USACE Draft Report containing its draft technical review of the remedial alternatives.

- Several significant high water events occurred in the San Jacinto River, including a 10 to 20-year flood during April 2016 (USGS, 2016) with no observed adverse effect on the Armored Cap.

- Two additional years of O&M were completed, during which maintenance was performed in small areas of the Armored Cap in accordance with USEPA-approved maintenance plans (with no loss of material from beneath the Armored Cap) and additional security measures were implemented for the Armored Cap.

- Region 6 asked USACE to develop the Additional Removal Alternative.

- Texans Together submitted the Garland Report to USEPA, containing a comparison of the remedy options for the Northern Impoundments with those selected at other CERCLA sediment sites.

[5] As noted in the June 2014 Comments (Appendix A)**,** Respondents were unable to identify any instance in which an engineered cap constructed either as an interim or final remedy has subsequently been removed. *See* June 2014 Comments at 3-4. That is still the case.

A. USACE Technically Reviewed the Armored Cap Design and Construction and Concluded the Capping Alternative is Stable and Permanent

In 2015, the USACE issued the USACE Draft Report describing its "evaluations to address the permanence of the existing repaired [TCRA] cap with the proposed modifications outlined in the capping Alternative 3N of the Draft Final Interim FS." USACE Draft Report at ES-1. USACE concluded that the Armored Cap, with the enhancements included in Alternative 3N, "is expected to be stable and permanent, requiring only maintenance or repair following unusual catastrophic events." *Id.* at ES-1. The USACE also concluded that the Armored Cap as enhanced (Alternative 3N) is predicted to have long-term reliability in withstanding scour-related processes, and that the slope improvements proposed as part of Alternative 3N will provide the USACE-recommended factor of safety for slope stability. *Id.* at ES-1. [6]

In preparing the USACE Draft Report, the USACE performed evaluations to assess the effectiveness of the existing enhanced Armored Cap with the proposed modifications outlined in capping Alternative 3N (the Permanent Cap) and showed that the Permanent Cap is expected to be "highly effective." *Id.* at ES-2. The USACE also concluded that any suspension and releases from capping will be very small compared with those associated with the removal alternatives, and that the Armored Cap effectively controls bioaccumulation. *Id.* at ES-2.

With respect to barge strikes (one of the potential "unusual catastrophic events" evaluated by the USACE), the USACE concluded there is a "low probability of barge strikes that would impact the integrity of the cap." *Id.* at ES-1. The USACE also noted that potential impacts from barge strikes could be avoided by constructing pilings around the Armored Cap. *Id.* at 54. Alternative 3N includes construction of an underwater berm around the Permanent Cap that would effectively serve the same function as the pilings.

Comments have been made by local opponents of the capping alternative regarding uncertainty associated with modeling assumptions used in the FS. The USACE concluded, however, that the model set up and boundary conditions presented in the FS did not result in a significantly different conclusion than USACE's own evaluation of the hydrodynamic, sediment transport, and chemical fate and transport modeling. *Id.* at 26-28. Although the USACE initially had concerns about the data source chosen for the water surface elevation in the model, the USACE's sensitivity results state that the USACE "…comparison quantified that the location of [the FS] boundary was located sufficiently far from the San Jacinto River Site so as to not impact the results of either [the] sediment transport model or contaminant transport models in proximity to the Site." *Id.* at 26. Similarly, the USACE had previously suggested that use of a hard bottom in the upper San Jacinto River was a weakness in the FS model, but ultimately concluded that this assumption had minimal impact on model results. *Id.* at 27-28.

B. The Armored Cap Has Demonstrated its Stability Through Several High Water Events

Interested parties have also commented to USEPA that the Armored Cap has not been evaluated for a significant storm event, and have implied that there is significant "uncertainty" regarding the performance of the Armored Cap over the long term. To the contrary, the FS used detailed hydrodynamic and engineering evaluations to determine appropriate Armored Cap design criteria, such as appropriate slope

[6] The Executive Summary from the USACE Draft Report is provided in Appendix B. Respondents also submitted comments regarding the USACE Draft Report in a letter dated September 17, 2015 from Respondents' contractor, Anchor QEA, to USEPA Region 6.

aspects and material types and sizes (Appendix B of the FS) for 100-year storm events, and discusses how the Armored Cap was designed to be stable under storms as large as or larger than the 500-year flood.[7]

Moreover, subsequent to the submission of Respondents' June 2014 Comments, there have been at least two high water events in the San Jacinto River, including an approximate 10- to 20-year flood that occurred between April 19 and April 22, 2016 (USGS 2016). Shallow water high flows, such as those that occurred during the April 2016 flood, represent an extreme flood flow on the Armored Cap because the water level is not deep enough to attenuate the shear stress acting on the Armored Cap. Inspection of the Armored Cap conducted after the April 2016 flood event in the San Jacinto River confirmed that the armor rock installed during the TCRA construction, as enhanced in January 2014, was stable, and that no scour had occurred (Anchor QEA 2016c).

C. During the Last Two Years, Maintenance as Contemplated by the OMM Plan Has Been Performed and Supplemental Security Measures Have Been Implemented

The Armored Cap has now successfully undergone an additional two years (and a total of five years) of O&M. Since the submittal of the June 2014 Comments, there were three occasions on which the need for maintenance in small areas of the Armored Cap was identified, with the maintenance then being performed quickly pursuant to USEPA-approved maintenance plans and with no loss of waste material from beneath the Armored Cap.[8] The areas in which maintenance was performed collectively represent less than 0.07% of the total surface area of the Armored Cap.

In December 2015, a USEPA dive team inspection of the Armored Cap identified an area in the Northwestern portion of the Armored Cap at which the presence of armor rock could not be confirmed at the original design thickness. The area was determined through probing to be approximately 20 feet by 15 feet (or 0.04% of the total surface area of the Armored Cap) and to be covered by three inches or more of armor stone (Anchor QEA 2016a). The loss of armor stone within the maintenance area appeared to have potentially resulted from a barge strike, given the maintenance area's dimensions and location. Surface sediment samples were collected from locations adjacent to this area, in both upstream and downstream areas. These surface sediment samples demonstrated that there had been no loss of waste material from beneath the Armored Cap (Anchor QEA 2016a). Maintenance was promptly performed to add additional armor stone to this area in accordance with a USEPA-approved work plan.

Extremely low tides in late February 2016 allowed for visual inspection of areas of the Eastern Cell that are normally underwater. During this visual inspection, visible geotextile was noted in five locations (ranging from 1 foot by 1 foot to 2 feet by 3 feet), and maintenance was performed in those areas (Anchor QEA 2016b). In response to these initial visual observations, the Respondents implemented an intensive probing inspection and delineated other small areas in the Eastern Cell (representing a total of 170 square feet, or 0.02% of the total surface area of the Armored Cap) at which additional maintenance was performed (Anchor QEA 2016b). In all of these areas, the presence of geotextile was confirmed and no releases had occurred.

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[7] While the FS presents results for the 500-year flood (Anchor QEA 2014, Appendix B), events larger than the 500-year flood are expected to cause similar (or lower) stresses on the Permanent Cap because the depth of the water at the Site would be greater under these larger storms and, thus, not create as much stress on the Permanent Cap.

[8] The maintenance performed on the Armored Cap is described in reports submitted to USEPA dated January 26, 2016, April 18, 2016 and May 26, 2016; these reports, which are included in the list of references, address the Armored Cap maintenance events in greater detail than allowed in this submission.

In connection with the April 2016 quarterly inspection of the Armored Cap, two additional small areas of exposed geotextile with armor stone present at less than the designated thickness were identified and maintenance to address the two areas was then completed (Anchor QEA 2016c). These two areas totaled about 18 square feet.

Coincident with the March 2016 maintenance event, the Respondents implemented additional security measures for the Armored Cap. These measures included installation of 24 hours per day, seven days per week monitored security cameras, and installation of a continuous line of perimeter buoys around the Armored Cap. These additional security measures will further enhance the ongoing O&M that will be incorporated into Alternative 3N. Moreover, the frequency of future maintenance events will be mitigated as a result of the Permanent Cap design features such as further flattening of the slopes (particularly in the Northwestern portion of the cap), the use of larger rock and the construction of a barrier to prevent barge strikes.

D. <u>The Specifics of Any Removal "In the Dry" Have Not Been Identified, But Removing the Waste in the Dry Would Not Only Be Technically Challenging But Would Involve Significantly Increased Risks for Releases, Particularly During Storm Events Similar to the One That Occurred in April 2016, and Would Not Be Cost-Effective</u>

USEPA asked the USACE to develop the Additional Removal Alternative, which would involve full removal (as in Alternative 6N) with the removal occurring partially "in the dry." Respondents have only been provided with an outline of the major elements of this alternative, and no details as to how it would be implemented or regarding its schedule or cost have been made available. To the extent this additional alternative has not been fully developed consistent with the requirements of the NCP, it should not be considered by the Board.

As outlined by the USACE, the "dry" removal alternative could only be implemented in areas of the Armored Cap that are above an elevation of -3 ft NAV88. This alternative would involve removal of the Armored Cap, underlying geomembrane, and geotextile, prior to dredging of the waste material. This would directly expose the underlying disturbed waste material to the surrounding environment making it susceptible to release. The area would be especially susceptible to release from exposed waste during the frequent storm events that occur in the Houston-Galveston area. The projected construction time for Alternative 6N is 16 months. No schedule has been provided for the Additional Removal Alternative, but to the extent that it would involve longer periods in which waste material would be exposed, the potential for storm events to occur that would result in the possibility of releases of exposed waste would be increased.

Performing a portion of the removal in the "dry" would conceivably involve the following:

- <u>Raising berms around the Northern Impoundments and installing sheet piling within the berms to facilitate dewatering</u>. The Additional Removal Alternative assumes that the sheet piling and berm top elevation would be sufficient to protect against a 50-year flood event. As described in the FS, the predicted elevation of the 50-year flood is +10.8 feet NAVD88 (Anchor QEA 2014, Appendix B). Presumably, to prevent overtopping by waves, at least two feet of additional freeboard would be needed, and thus we assume USACE anticipates that the berms and sheet piling would need to be raised to at least elevation +13 feet NAVD88.

- <u>Dewatering the areas of the eastern and western cells to the extent practicable and treating water as needed to control releases</u>. The details as to how and where the treatment would occur have not been described, although the USACE may contemplate barge-based treatment.

- Removing the Armored Cap, geomembrane and geotextile within the cells in the dry to the extent practicable.

- Removing waste materials in the dry to the extent practicable. The removed waste material would have to be dewatered or solidified for disposal in an off-site disposal facility. An as-yet unidentified off-site waste management facility (probably several miles from the location of the Northern Impoundments) will be required for material staging, stabilization and processing for bulk transportation to an off-site landfill, and issues related to the availability and required size of the required waste management facility are not addressed except that the USACE apparently contemplates that some operations, such as water treatment, could be barge mounted.

- Covering the dredged surface with two layers of clean fill to limit intermixing of residuals with fill.

Constructing berms and sheet piling to an elevation with sufficient freeboard above the 50-year flood (i.e. + 13 feet NAVD88) would present a significant implementability challenge. The entirety of the Northern Impoundments is below this elevation. The work area would therefore need to be fully enclosed on all sides by new structures. Respondents also question the effectiveness of dewatering the work area for a "dry" removal, given that the work area is surrounded on three sides by the river under normal conditions and would be completely surrounded on all four sides during a 50-year flood. Constructing a water-tight barrier would be a significant challenge that could require continuous pumping to maintain relatively dry conditions in the work area. Management of the dewatering effluent would exacerbate the implementability challenges associated with this alternative.

The Additional Removal Alternative has the additional disadvantage of requiring several waste handling and disposal steps, including dewatering overlying surface water and associated water treatment and disposal, off-site dewatering and solidification of solid waste, and bulk material transportation to an off-site hazardous waste landfill. All of these handling steps require large amounts of space, which is limited around the Northern Impoundments. In fact, these waste management activities would have to be conducted several miles from the Northern Impoundments at an as-yet unidentified location resulting in exposure of the environment and the public to risks associated with potential releases and operational accidents from the time the waste is exposed to when it is transported for stabilization and processing and then when it is transported for ultimate disposal in a landfill. Authorization for management of the waste at these other locations would also have to be obtained.

The full removal alternatives are not cost-effective and were ranked unfavorably in the FS; the Respondents expect that implementing the BMPs associated with the Additional Removal Alternative would result in an even less favorable ranking of its cost-effectiveness. The NCP requires that "[e]ach remedial action selected shall be cost-effective." Alternative 3N is the most cost-effective remedial alternative. The NCP Preamble further defines cost-effectiveness as "costs [that] are proportional to [the remedial alternative's] overall effectiveness." Alternative 3N effectively and permanently reduces risk in a cost-effective manner (in the range of $12.5 million, inclusive of the construction costs of the Armored Cap). The other remedies, which range from $23.2 to $99.2 million (for Alternative 6N) to potentially significantly more (for the Additional Removal Alternative), are simply not cost-effective.

Also, any alternative that entails constructing berms and sheetpiles around the entire work area, and ongoing de-watering, will require significantly longer to implement than any of the alternatives developed in the FS. The longer construction period will magnify the risk related to storms occurring during construction, and extend the duration over which community impacts would occur. The April 2016 flood further highlighted these risks. The flooding was triggered by historic rainfall of more than 17 inches in a single day – an event that caught many local residents off guard. Water levels in the San Jacinto River

rose over eight feet in a single day (Harris County, 2016). If a "dry" remediation were underway at the Northern Impoundments during this flood, it would have been extremely difficult, if not impossible, to prevent the loss of waste material beyond the work area, and it would have been equally difficult to respond to such a loss considering that major roadway access to the Site was closed for at least four days due to flooding.

Finally, the Additional Removal Alternative will involve increased worker safety risks, associated with the construction of the berm and sheetpile walls, the off-site waste management activities involved and its likely longer period of construction. It will also involve greater emissions and community impacts, in part due to its extended duration, but also due to the additional waste handling and disposal steps involved and the need to transport the wastes to off-site waste management facilities located some distance from the work site.

E. The Garland Report Does Not Provide any Basis for Rejecting A Capping Remedy at this Site

The Garland Report does not provide any basis for rejecting Alternative 3N. It is presented as an analysis of seven CERCLA sediment sites at which, according to Dr. Garland, USEPA had "addressed similar COCs in similar geographic and hydrologic settings to the [Site]." Garland Report at 14. According to the Garland Report, "[i]n all cases, remedy selection for dioxin-contaminated sediments included physical removal of the most highly contaminated sediments unless such removal would cause channel or bank instability," with the only exception being a site in which "physical removal would have dramatically altered the benthic ecosystem as well as the morphology of the contaminated area." *Id.* at 17.

Local opponents have repeatedly pointed to this report as a reason to reject capping as a remedy at the Site. As addressed below, the report's analysis of the remedies selected at other sediment sites is flawed and does not support the report's conclusions. In addition, Dr. Garland, who has a Ph.D. in Geology and is a lecturer in the Environmental Management Program, School of Business at the University of Clear Lake Houston, does not appear to have specific experience or expertise with CERCLA sediment sites, a consideration which goes to the weight to be afforded her analysis and conclusions.

An evaluation of information about these seven sites, set forth in Appendix C to these supplemental comments, demonstrates that (1) USEPA acknowledged the viability and protectiveness of capping as a remedy in connection with these sites – even for what Dr. Garland characterizes as the "most highly contaminated sediments," (2) capping was selected by USEPA as a remedy at a number of these sites, contrary to the assertion that in all but one site "remedy selection for dioxin-contaminated sediments included physical removal," and (3) where USEPA selected a removal option, it was because of circumstances in which capping was not a viable option (such as the presence of a chemical that was not suitable for capping, the potential for future navigational dredging within the cap footprint or reductions in water depth from capping materials that may have impeded commercial barge traffic and restrict drainage).

The Respondents also disagree with the idea that there is "uncertainty" in the long-term performance of a capping remedy. Caps have been successfully constructed as a remedial approach for multiple Superfund Sites over the last 30 years; cap construction has been documented as early as 1967, and remedial capping guidance was developed in the 1980's (Palermo and Reible 2007). The Armored Cap has been in service for nearly five years with regular inspections. The maintenance that has been performed during that time has been readily implemented as an expected element of the OMM Plan. It has also been demonstrated to have performed well during high water events. In short, the Armored Cap has a track record of demonstrated performance under extreme conditions, and has been shown to be protective under these conditions.

II. THE PERMANENT CAP SHOULD BE SELECTED AS THE REMEDY FOR THE NORTHERN IMPOUNDMENTS

The Respondents implemented a USEPA-approved TCRA (*i.e.*, the Armored Cap) in 2011 to prevent the release of waste constituents from the Northern Impoundments to the San Jacinto River. Five years later, after enhancement of the cap in January 2014 to satisfy USACE specifications, the Armored Cap has proven its ability to effectively contain the Site waste. Under Alternative 3N, the Armored Cap will be further enhanced and protected from potential barge strikes. These additional protective measures, in addition to regular monitoring and maintenance, will ensure long-term protectiveness. This is particularly true in light of the extremely dense, fibrous nature of the underlying waste and highly immobile and hydrophobic nature of the primary constituent of concern. The Permanent Cap is, by far, the most cost-effective remedy for the Northern Impoundments, meeting the NCP's requirement to select the remedy whose risk reduction is proportional to its associated incremental costs, and meets all of the NCP's other remediation criteria, and should be selected as the remedy for the Northern Impoundments.

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USGS 2016. Gage readings for USGS station 08072050 on the San Jacinto River near Sheldon, Texas. http://nwis.waterdata.usgs.gov/tx/nwis/uv/?cb_00065=on&format=gif_default&site_no=08072050&period=&begin_date=2015-04-24&end_date=2016-04-24

COMMENTS OF INTERNATIONAL PAPER COMPANY (IP) AND MCGINNES INDUSTRIAL MAINTENANCE CORPORATION (MIMC) ON THE REMEDIAL ALTERNATIVES FOR THE SAN JACINTO RIVER SUPERFUND SITE (SITE)

IP and MIMC respectfully submit these comments to the National Remedy Review Board (Board) regarding the remedial alternatives being considered by Region 6 of the United States Environmental Protection Agency (USEPA) to address dioxins in the northern area (Northern Impoundments) and the portion of the Site investigation area south of Interstate Highway 10 (Southern Area).[1] In 2011, the Northern Impoundments were the subject of a $9 million time-critical removal action (TCRA) to completely isolate all material in the Northern Impoundments under an armored cap. This robustly engineered armored cap (Armored Cap) was constructed using stone as armor, geotextile, and geomembrane and was designed to United States Army Corps of Engineers (USACE) standards to withstand 100-year storm and 500-year flood events, including events such as the October 1994 flood (a 50 to 100-year flood), Hurricane Ike (a 2-year flood), and Tropical Storm Allison (a 5-year flood). Further, after minor sloughing of some of the rock from a discrete part of the cap in July 2012, the Armored Cap was enhanced in January 2014, pursuant to USACE recommendations. This resulted in a more stable and protective cap configuration.

We urge the Board to undertake a full and objective evaluation of the range of alternatives including the actual efficacy of each alternative, the risks of implementing each such alternative, and its cost-effectiveness. The Board was created in 1995 to "help control remedy costs and to promote both consistent and cost-effective decisions at Superfund sites."[2] In creating the Board, USEPA emphasized that "cost plays an important role in Superfund response actions," and acknowledged CERCLA's mandate that "all remedies must be cost-effective."[3] In this case, the Board's review of the costs of the remedial alternatives is particularly important because the relative costs of the alternatives are widely divergent – notwithstanding that the efficacy and protectiveness of the remedial alternatives are not. As demonstrated below, this is a unique situation where more spending will likely decrease the protectiveness and the efficacy of the remedy. As the March 21, 2014 Feasibility Study (FS) for the Site demonstrates, enhancing and maintaining the Armored Cap as the permanent remedy is the most effective means of permanently containing and isolating the wastes. In contrast, the sediment removal alternatives may result in resuspension and dispersal of the wastes, as well as have enormous costs and potentially cause increased fish tissue concentrations of dioxins and environmental releases. Thus, an objective comparison of these alternatives results in a clear conclusion that the recommended remedy is the most environmentally protective and cost effective at the same time, while also fulfilling the National Contingency Plan's (NCP) policy that removal actions should be consistent with the final remedy.

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[1] Harris County, which is in litigation with IP and MIMC, has submitted extensive comments to the Board which are not driven by any technical assessment of the efficacy of the potential remedies, but rather appear designed to inappropriately vilify IP and MIMC. Attached as Appendix A are IP's and MIMC's responses to some of the misstatements in Harris County's comments.

[2] Memorandum from Elliot P. Laws, Assistant Administrator Office of Solid Waste and Emergency Response, *Formation of National Remedy Review Board* (November 28, 1995) at 1.

[3] *Id.*

1. EXECUTIVE SUMMARY

The USEPA should select Alternative 3N in the FS for the Site as the final remedy for the Northern Impoundments and Alternative 2S for the Southern Area. Alternative 3N is a multi-layered, robustly engineered Armored Cap that provides a full and complete protective remedy by permanently isolating the waste materials in the Northern Impoundments (Permanent Cap). The Permanent Cap can withstand storms such as the October 1994 flood (a 50- to 100-year flood), Hurricane Ike (a 2-year flood), Tropical Storm Allison (a 5-year flood), because it has been designed to withstand a 100-year storm event and a 500-year flood event. It should be noted that the Northern Impoundments, based on aerial photographs, remained intact (with the waste remaining in place) following the 1994 flood (the strongest of these storm events) without the benefit of the Armored Cap. Not only is the paper mill waste in the Northern Impoundments a very cohesive, stable material, but these impoundments lie within the inner portion of a natural river bend where hydrodynamic forces are lower compared to forces on the outer part of the bend or within the main channel of the river during normal flows as well as storm and flood events. The robust nature of the Armored Cap, its location within the river bend, and the cohesive, stable nature of the waste under the cap, all contribute to the long-term sustainability of Alternative 3N. Unlike the stabilization and dredging alternatives (Alternatives 4N-6N in the FS), Alternative 3N incorporates the current Armored Cap constructed as part of the TCRA.[4] Maintaining and enhancing the Armored Cap complies with CERCLA and the important policy set out in the NCP that removal actions should be consistent with the final remedy and should to the extent practicable, contribute to the efficient performance of any long-term remedial action.

Alternative 3N ranks the highest in an analysis of all of the remedial alternatives under the NCP's 9 criteria. Alternative 3N offers the greatest overall protectiveness, complies with all applicable or relevant and appropriate requirements (ARARs), incorporates a treatment component that occurred during construction of the current Armored Cap, is the most effective from a short-term and long-term perspective, and is implementable, with no impacts to the flood capacity of the river. Alternative 3N stands out as the most cost-effective of the remedial alternatives under the standards set out in the NCP. Under Alternatives 4N, 5N, 5aN, and 6N, by contrast, the existing Armored Cap would be partially or fully removed. Most significantly, under Alternatives 4N, 5N, 5aN and 6N, the waste under the Armored Cap would be disturbed, impacted sediments would be resuspended, and the exposed materials would be subject to potential storms or floods during construction, thereby increasing risks to the environment. Furthermore, these alternatives are not cost-effective, providing less incremental risk reduction than Alternative 3N due to likely releases during construction that may cause long-term site impacts (see Figure 1 on page 15.) Specifically, the cost of Alternative 3N differs from the cost of Alternative 6N by almost $90 million, so Alternative 6N's cost is nearly an order of magnitude higher than that of Alternative 3N.

Similarly, Alternative 2S for the Southern Area ranks the highest of all of the remedial alternatives for the Southern Area under the NCP's 9 criteria. Alternative 2S would provide a full and complete protective remedy against the only potential risk -- exposure of potential future construction workers -- by placing

[4] For the Northern Impoundments, the TCRA evaluation and design process completed in 2010 included a remedial alternatives evaluation. The alternatives evaluation considered five different alternatives that involved different variations of capping and removal. At the end of that process, USEPA chose the Armored Cap as the preferred TCRA alternative in its decision document for the TCRA and required that the cap be designed and constructed to withstand a 100-year flow event.

deed restrictions in three discrete areas. This is also the most cost-effective remedy for the Southern Area, because no material incremental protectiveness would be achieved by excavation.

1.1. The Northern Impoundments

In May 2010, IP and MIMC entered into an Administrative Order on Consent (AOC) with USEPA pursuant to which they agreed to implement a TCRA to isolate the materials in the Northern Impoundments within an armored cap. The Armored Cap is a robust, fully engineered cap, using stone as armor, together with geotextile and geomembrane. It meets the USACE design standards for withstanding a 100-year storm and a 500-year flood event, a range of conditions that includes storms equivalent to Hurricane Ike, Tropical Storm Allison, and the October 1994 flood (2-year, 5-year and 50- to 100-year floods, respectively). The construction of the Armored Cap was completed in July 2011 at a cost to IP and MIMC of approximately $9 million. The Armored Cap was enhanced in January 2014 by flattening some slopes and adding larger rock to implement USACE recommendations, moving its design from "minor displacement" to "no movement" under USACE's cap design criteria.

The FS presents seven remedial alternatives for the Northern Impoundments. Under Alternatives 1N and 2N, the Armored Cap would remain as constructed and as enhanced in accordance with USACE recommendations. Under Alternative 3N, the Armored Cap would be strengthened and made permanent by adding additional armoring, further flattening the slopes, and implementing measures to protect the Armored Cap from vessel traffic. Under Alternatives 4N, 5N, 5aN, and 6N, the Armored Cap would be temporarily or permanently removed for 16 to 19 months, while dredging and/or solidification of the underlying waste materials occurs. USEPA should select Alternative 3N (Permanent Cap) for the following reasons:

1. **Conversion Of The Armored Cap Into An Even Stronger Permanent Cap Is Consistent With CERCLA And The NCP.** Incorporating the protective Armored Cap into the final remedy would be consistent with the provisions of CERCLA Section 104(a)(2) and NCP Section 300.430(a)(ii)(B), which stress that removal actions should, to the extent practicable, contribute to efficient performance of any long-term remedial action and that interim actions should be consistent with the final remedy. Alternative 3N would be consistent with the TCRA in that it would enhance the existing Armored Cap to incorporate it into the final remedy, the proposed Permanent Cap.

2. **Removal Of The Armored Cap Would Be An Unprecedented Step and Unnecessarily Create Risks.** Alternatives 4N, 5N, 5aN, and 6N, in contrast to Alternative 3N, would result in the removal of part or all of the Armored Cap, which as previously described, is a robust, engineered cap, constructed in compliance with (and in exceedance of) USEPA and USACE cap design guidance. The removal of a fully functional engineered cap would be a dramatic and unprecedented step, especially because capping is a proven, effective and protective remedy endorsed by USEPA's sediment guidance (USEPA *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (December 2005)) (Sediment Guidance) and USACE guidance.[5] IP and MIMC researched whether any precedent exists for removing an engineered cap constructed as part of an interim remedy (as opposed to non-engineered caps, such as sacrificial interim measures). That research included contacting USEPA Headquarters and Dr. Danny Reible of Texas Tech University, an internationally renowned expert on sediment caps, and obtaining results of a survey that reached over

[5] The references in these Comments are included in the detailed list of references attached to the FS.

350 individuals affiliated with the Sediment Management Work Group. None of these sources was aware of the removal of any engineered caps constructed either as an interim or as a final remedy. Further, as described below, removal of the Armored Cap will create significantly greater environmental risks than will leaving it in place and strengthening it. Prospectively, it would have a chilling effect on responsible parties who are considering implementing expensive early actions that are expected to be consistent with and incorporated in the final remedy.

3. **The Armored Cap Has Been Through Several Years Of Successful O&M. In Addition, USACE Recommendations To Strengthen The Cap Have Been Implemented And The Armored Cap Has Been Evaluated As Appropriate And Protective In A Third-Party Peer Review.** The Armored Cap has been through several years of operation and maintenance. It has performed well, and as discussed in Section 3.2.3, fully performed its function by protecting against any release of waste materials during one minor maintenance event in 2012. Subsequently, the USACE performed an evaluation of the Armored Cap and provided recommendations regarding improvements that were implemented by IP and MIMC. Noted capping expert, Dr. Danny Reible of Texas Tech University, recently completed a peer review of the existing enhanced Armored Cap and the proposed remedial alternatives. Dr. Reible concluded that the existing enhanced Armored Cap is appropriate and protective to address Site conditions and will be effective into the future. Dr. Reible also reviewed the various alternatives under consideration in the FS and concluded that Alternative 3N provides the best alternative.

4. **The Permanent Cap Would Withstand Events Greater Than A 100-Year Storm And A 500-Year Flood.** The Armored Cap meets all ARARs and under Alternative 3N, the strength and protectiveness of the already enhanced Armored Cap would be further enhanced beyond its current ability to withstand a 100-year storm and 500-year flood event.

5. **Removal Of The Armored Cap Would Likely Cause Resuspension Of Sediment And Increase In Fish Tissue Concentrations.** Under Alternative 3N, the waste would remain isolated and contained under the Permanent Cap, and would not be disturbed, but rather, would be made even more secure. By contrast, under Alternatives 4N, 5N, 5aN, and 6N, the multi-layered Armored Cap would be partially or fully removed to allow the underlying waste material, a portion of which is located beneath the waterline, to be dredged, stabilized, and/or removed. Such action will result in disruption of the existing intact and consolidated paper pulp material, which in turn will inevitably result in resuspension of impacted sediments, thereby likely resulting in increases of contaminant concentrations in fish and shellfish for several years.

6. **Removal Of The Armored Cap Would Significantly Increase The Chance Of Exposure Of The Waste Material To A Storm Or Flood.** While Alternative 3N would further strengthen the Armored Cap without exposing the underlying waste to the environment, Alternatives 4N, 5N, 5aN, and 6N all involve the partial or complete removal of the Armored Cap such that the underlying waste material would be exposed to the environment. A 30 percent to 40 percent probability exists that a significant storm or flood event would occur during the 16 to 19 month construction period when the Armored Cap is removed (see FS, Appendix B). Such a storm or flood would risk overwhelming any best management practices (BMPs) used to mitigate resuspension of contaminants during normal flow events.

7. **The Permanent Cap Minimizes Worker Safety Risks, Environmental Impacts From Emissions And Community Impacts.** Alternatives 4N, 5N, 5aN, and 6N will require as many as 17,000 trips by trucks filled with excavated waste material, and present worker and public safety risks. Greenhouse gas, particulate matter (PM) emissions and ozone impacts are estimated to be more than 8 to 20 times higher than for Alternative 3N. Moreover, traffic and community impacts under these alternatives are estimated to be from 6 to 70 times greater than for Alternative 3N. Finally, the added impacts of securing an off-site materials management facility as well as transportation/receiving facility logistics (all of which are outside the scope of the FS) may cause a significant delay by extending the project duration for these four alternatives.

8. **In Addition To Its Environmental Benefits, The Permanent Cap Is The Most Cost-Effective Remedy.** The NCP requires that "[e]ach remedial action selected shall be cost effective." Alternative 3N is the most cost-effective remedy alternative. Cost-effectiveness is defined as "costs [that] are proportional to its overall effectiveness." Alternative 3N effectively and permanently reduces risk in a cost-effective manner (in the range of $12.5 million, inclusive of Armored Cap construction costs). The other remedies, which range in cost from $23.2 million to $99.2 million, are not cost-effective. Most importantly, they do not provide any material incremental risk reduction as compared to Alternative 3N, and actually involve the potential to create incremental risk and exposure, as a result of impacts to the environment in the form of resuspension, releases and residuals.

1.2. Southern Area

The Southern Area is located on a portion of the peninsula south of Interstate Highway 10 (I-10). The remedial alternatives for this area (Alternatives 1S to 4S) address three discrete locations at which subsurface soils contain dioxins above the applicable protective concentration level (PCL) for a hypothetical future construction worker. There are no risks to ecological receptors from the dioxin in this area.

Remedial alternatives for the Southern Area are: 1S (no further action); 2S (Institutional Controls (ICs)); 3S (enhanced ICs); and 4S (removal and off-site disposal). IP performed the remedial investigation/feasibility study (RI/FS) for the Southern Area and supports selection by USEPA of Alternative 2S for the following reasons:

1. **Deed Restrictions Can Ensure Protection Of Construction Workers.** The only potential risk in the Southern Area is to a hypothetical future construction worker who, in three discrete areas, might come into contact with dioxin above the receptor-specific PCL in the soil within the first ten feet below ground surface. This risk can be effectively avoided through deed restrictions (as provided for in Alternative 2S) which provide notice to future purchasers and construction workers of subsurface conditions.

2. **Deed Restrictions Will Be Effective On A Long-Term Basis.** Alternative 2S meets the ARARs and deed restrictions and will be effective on a long-term basis to protect potential future construction workers.

3. **Deed Restrictions Provide The Most Cost-Effective Remedy.** Consistent with requirements of the NCP regarding cost effectiveness, Alternative 2S is a cost-effective remedy for the Southern Area

because no material incremental protectiveness would be achieved by excavating sub-surface soils that are not posing any present unacceptable risk.

2. BACKGROUND

IP and MIMC have conducted an RI/FS for the Site, which is located on the western side of the San Jacinto River at the I-10 bridge. The RI/FS addresses the area within the USEPA's preliminary Site perimeter (USEPA's Preliminary Site Perimeter), which includes both the Northern Impoundments and the Southern Area.

The results of IP's and MIMC's comprehensive study of environmental conditions within the USEPA's Preliminary Site Perimeter were summarized in a remedial investigation report (RI Report), submitted to and approved by USEPA in May 2013. The RI determined that the otherwise stable waste, placed in the Northern Impoundments between September 1965 and May 1966, had been physically dredged out of one of the impoundments in the late 1990's/early 2000's by a neighboring landowner, resulting in the need for the RI/FS. The TCRA included construction of the Armored Cap to isolate the dioxin-containing waste materials in the Northern Impoundments during the RI/FS process. The RI included analyses and collection of data that demonstrated the positive impact of the TCRA on Site conditions.

Following submission of the RI Report, IP and MIMC submitted a Remedial Alternatives Memorandum, draft FS and then the March 21, 2014 FS containing a detailed analysis of the potential remedial alternatives for both the Northern Impoundments and Southern Area. The FS evaluates these alternatives relative to the CERCLA remedy selection criteria described in the NCP. 40 CFR § 300.430(e)(9). A comparative net risk evaluation, as recommended by the USEPA and the National Academy of Sciences Committee on Remediation of PCB-Contaminated Sediments (NRC 2001; USEPA 2005), was used in considering both the benefits of a remedial approach and the risks associated with its implementation (USEPA 2005; Nadeau 2008).

2.1. Remedial Alternatives for the Northern Impoundments

Seven remedial alternatives for the Northern Impoundments were evaluated. The alternatives are based on containment, removal, and/or a combination of containment, treatment, and removal together with ICs. Implementation of Alternatives 1N and 2N would maintain the Armored Cap in its current form. Alternative 3N would enhance and increase the long-term stability of the Armored Cap by creating the Permanent Cap, which would then be monitored and maintained, all without disturbing the material that is already contained and isolated from potential receptors. Alternative 3N would also include measures to protect the Permanent Cap from vessel traffic. Implementation of Alternatives 4N, 5N, 5aN, and 6N would require removing all or part of the existing Armored Cap, followed by stabilization, or dredging of the underlying waste deposits. Except in the case of the full removal option (6N), when the work was completed, a new cap to replace and upgrade the removed and discarded Armored Cap would then be installed. The estimated cost of these seven alternatives range from $9.5 million to $99.2 million.

The most effective, optimal and appropriate of these alternatives is the Permanent Cap (Alternative 3N). Consistent with USEPA and USACE guidelines, Alternative 3N builds on the existing Armored Cap, which has been effective in containing and isolating impacted materials. Unlike those alternatives that require removing all or parts of the Armored Cap during construction, Alternative 3N satisfies the provisions of CERCLA and the NCP cited above that specify that an interim remedy should not be

inconsistent with the final remedy.[6] It avoids the documented risk of releases and implementation uncertainties associated with the alternatives involving either stabilization or excavation. Finally, given the estimated cost of the stabilization and excavation alternatives which differ by nearly an order of magnitude, Alternative 3N is the only alternative that satisfies the requirement that a selected remedy be cost-effective.

2.2. Remedial Alternatives for the Southern Area

For the Southern Area, the only risk identified during the RI was to a hypothetical future construction worker who might, in three discrete locations, come into contact with soil at depths between one and ten feet below ground surface containing dioxins at levels greater than the applicable protective concentration level (PCL). The remedial alternatives applicable to those areas, in addition to the "no further action" alternative (Alternative 1S), include ICs (Alternative 2S), enhanced ICs (Alternative 3S), and removal and off-site disposal (Alternative 4S). The cost of the ICs and enhanced ICs are $270,000 and $670,000 respectively, while the cost of Alternative 4S is $9.93 million. Given the limited nature of the risk, ICs (Alternative 2S) provide the most appropriate and cost-effective remedy.

3. ENHANCING THE ARMORED CAP TO CREATE A PERMANENT CAP (ALTERNATIVE 3N) IS THE MOST EFFECTIVE AND OPTIMAL REMEDY FOR THE NORTHERN IMPOUNDMENTS

3.1. Alternative 3N Will Strengthen the Armored Cap to Create a Permanent Cap

Alternative 3N builds on the effectiveness of the Armored Cap (designed and constructed at a cost in excess of $9 million). It further strengthens the existing Armored Cap to create the Permanent Cap by adding additional armoring, flattening slopes and implementing additional measures to provide protection from vessel traffic (Permanent Cap).

More specifically, the cap enhancements that are part of Alternative 3N include adding armor stone sized to provide a factor of safety of 1.5 (rather than the minimum 1.1) and to satisfy "no displacement" design criteria. They also include flattening the existing slopes to create a final slope with a 3:1 horizontal to vertical ratio in submerged areas and a 5:1 horizontal to vertical ratio in the surf zone. The reduced slopes will enhance the Armored Cap's resistance to wave and wind action, and add an additional "factor of safety" to the design that exceeds that which is required by USACE and USEPA guidance. The Permanent Cap also includes both ICs and physical barriers to protect the Armored Cap from physical impacts from marine traffic operating near the Armored Cap.[7]

3.2. The Armored Cap Is Effective in Isolating Waste Materials in the Northern Impoundments

3.2.1. TCRA Construction and Design

Installation of the Armored Cap has isolated waste and sediments within the original 1966 perimeter berm of the Northern Impoundments to prevent the release of dioxins and other chemicals of potential concern to the environment (Anchor QEA 2011, 2012a).

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[6] CERCLA guidance contemplates that such "early action" (before all site investigation and full remedy evaluation have been completed) may be undertaken to promptly address the site conditions but should not be inconsistent with the final remedy for the site.

[7] For purposes of FS cost development, a conceptual submerged perimeter rock berm was included as a component for Alternative 3N to further ensure the long-term protectiveness of the Permanent Cap.

The Armored Cap, completed in 2011, incorporates armor stone, geotextile, and geomembrane layers over approximately 15.7 acres. It was designed in accordance with USACE guidance and the Sediment Guidance to withstand a 100-year storm event with an additional factor of safety to ensure its long-term protectiveness (USEPA 2005).[8] The storm event defines the forces generated under different flow conditions that the cap armor layer must resist. The potential risk to the Armored Cap from storms equivalent to Hurricane Ike, Tropical Storm Allison, and the October 1994 flood (2- year, 5-year, and 50- to 100-year events), and even larger storm events, up to a 500-year event, was later evaluated for the FS. This evaluation showed that the Armored Cap is designed and capable of withstanding all of these events, including a 500-year flood event (see Appendix B of the FS). The Northern Impoundments remained intact during and following the 1994 flood without the benefit of the Armored Cap. These impoundments lie within the inner portion of a natural river bend where hydrodynamic forces are lower than forces on the outer part of the bend or within the main channel of the river during normal flows and storm and flood events. Moreover, the paper mill waste placed in the Northern Impoundments is a very stable material with very low permeability of 10-6 cm/sec to 10-7 cm/sec. The robust nature of the Armored Cap, its location within the river bend, and the stable nature of the waste within the Northern Impoundments all contribute to the long-term sustainability of this remedy. The Armored Cap's effectiveness is also demonstrated by a USEPA-approved porewater study, developed by Dr. Danny Reible, that was conducted in 2012 (see Section 5.3 of the RI Report).

3.2.2. Monitoring and Maintenance of the Armored Cap

Since July 2011, the Armored Cap and the associated fencing, access controls, and signs have been routinely inspected and maintained by IP and MIMC pursuant to a USEPA-approved operations, monitoring and maintenance plan (OMM Plan). The OMM Plan was developed to address conditions that the USACE and USEPA cap design guidance expressly presume could occur post-construction (such as movement of rock cover in localized areas of a cap). The OMM Plan requires periodic monitoring (and monitoring following key storm events) to identify the need for possible cap maintenance, followed by appropriate repair activities (USEPA 2005; USACE 1998).

3.2.3. July 2012 Maintenance Event

In July 2012, a maintenance event occurred involving a minor displacement of rock in a localized area of the armor layer (the rock layer above the geotextile layer) of the Armored Cap. This was not a cap "failure." There was no exposure of waste materials and the geotextile and geomembrane layers of the Armored Cap remained intact. This event involved the movement of some rocks, and nothing more. Moreover, the displacement occurred on an outside berm and not in a location where waste materials are present.

This rock displacement was caused by some winnowing of the smaller, gravel material that was interspersed between the larger rock, which caused some of the larger armor stones to shift. These armor

[8] In addition to a 100-year storm event, storms with 5- and 10-year return intervals were also considered during the TCRA design because these more frequent storms could present design challenges, i.e., the water depth would be lower, which could result in higher shear stresses on the cap compared to a less frequent storm such as the 100-year design event. The enhancements included as part of the Permanent Cap address these high stress scenarios, e.g., use of armor stone sized to provide a factor of safety of 1.5 (compared to the minimum factor of safety, which is 1.1), flattening of submerged slopes to a 3:1 horizontal to vertical ratio, and flattening of surf zone slopes to a 5:1 horizontal to vertical ratio.

stones were, by definition, all located above the geotextile and geomembrane isolation layers. The affected areas totaled approximately 200 square feet, or 0.03 percent of the overall area of the Armored Cap. Importantly, as noted above, there was no exposure of material contained beneath the Armored Cap and no release of hazardous substances was associated with this temporary condition. The rock displacement was detected during a scheduled inspection of the Armored Cap and was promptly addressed in accordance with the approved OMM Plan. Maintenance was performed using locally available materials that had been stockpiled for that purpose under the OMM Plan. These maintenance activities were completed in July 2012 and were documented in a completion report for USEPA. No similar issues have been identified during subsequent monitoring events, which have demonstrated the continuing effectiveness of the Armored Cap in isolating and containing impacted materials.

3.2.4. Reassessment of the Armored Cap Design and Construction

At USEPA's direction, IP and MIMC conducted a post-construction evaluation of the Armored Cap. A separate reassessment by USACE on behalf of the USEPA was also performed, resulting in a report dated November 2013 (USACE Report). The USACE Report confirmed the overall validity of the Armored Cap's design but also contained recommendations to address certain construction issues that may have contributed to the July 2012 maintenance event and if implemented, would improve the Armored Cap's long-term protectiveness. In January 2014, IP and MIMC completed implementation of the USACE's recommendations, which advised flattening certain slopes and adding armor rock in selected areas. This enhancement work was conducted with larger-sized stone than recommended by the USACE, resulting in an even more stable and protective cap configuration exceeding design criteria specified in the USACE and USEPA sediment capping design guidance (USACE 1998). This work was documented in a completion report prepared for USEPA.

3.3. The TCRA's Armored Cap Has Been and Will Continue to be Effective and Protective, Particularly As Enhanced to Create a Permanent Cap

The effectiveness of the TCRA is also demonstrated by evaluating post-TCRA conditions and considering the impact of the TCRA on the 5 Remedial Action Objectives (RAOs) for the Site. The Armored Cap's design is further confirmed through additional modeling performed as part of the FS to evaluate impacts from storms larger than a 100-year storm.

As discussed in Section 3.2 of the FS, implementation of the TCRA achieved the RAOs for the area north of I-10. Specifically, construction of the Armored Cap has eliminated direct contact exposure for people, fish, and shellfish to wastes in the Northern Impoundments and sediments exceeding the PCL. In addition, as part of the porewater assessment developed by Dr. Reible and conducted following the Armored Cap's construction (Section 5.3 of the RI Report), sampling was completed on surface water and porewater within the Armored Cap with solid-phase microextraction fibers. The results of that evaluation showed that 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF) were not present at detectable levels in surface water over the Armored Cap. A groundwater study has also demonstrated that groundwater underlying the Northern Impoundments does not contain detectable levels of dioxin.

The modeling of cap performance carried out as part of the reassessment of the Armored Cap and incorporated and addressed in the FS demonstrates the ability of the Armored Cap to withstand wind and wave action, including a 100-year storm and 500-year flood event.

3.4. Capping Is a Proven, Effective and Protective Remedy Endorsed by USEPA's Sediment Guidance and USACE's Capping Guidance

In situ capping, as discussed in USEPA and USACE guidance (USEPA 2005; USACE 1998), is a proven technology that has been selected by USEPA for numerous sediment remediation sites across the United States. For example, in the Pacific Northwest, there are caps with more than 20 years of documented protectiveness. Additional examples are identified in Table 4-1 of the FS. The Armored Cap was designed in accordance with USEPA's and the USACE's capping guidance (USACE 1998) to withstand a 100-year storm event with an additional factor of safety to ensure long-term protectiveness. Virtually all of the conditions identified in Highlight 5-1 of the Sediment Guidance as especially conducive to capping are present here, and include:

- Suitable types and quantities of cap material are readily available;
- Anticipated infrastructure needs (e.g., piers, pilings, buried cables) are compatible with the cap;
- Water depth is adequate to accommodate the cap with anticipated uses (e.g., navigation, flood control);
- Incidence of cap-disrupting human behavior, such as large boat anchoring, is low or controllable;
- Long-term risk reduction outweighs habitat disruption, and/or habitat improvements are provided by the cap;
- Hydrodynamic conditions (e.g., floods) are not likely to compromise the cap or can be accommodated in the design;
- Rates of ground water flow in the cap area are low and not likely to create unacceptable contaminant releases;
- Sediment has sufficient strength to support the cap (e.g., higher density/lower water content, depending on placement method);
- Contaminants have low rates of flux through the cap; and
- Contamination covers contiguous areas (e.g., to simplify capping).

The USACE and USEPA cap design guidance expressly presumes that routine and event monitoring (triggered based on key storm events) should be performed to identify the need for possible cap maintenance, followed by appropriate repair activities (USACE 1998). The design guidance recommends that "event-based" monitoring be used to fine tune the OMM program after monitoring the performance of the cap following specific storm events. Typically, in the first few years following cap construction, there is a period where monitoring and maintenance practices identify and address areas of the cap that need to be enhanced, if any, so that the long-term protectiveness of the cap can be ensured. For example, two sediment caps with demonstrated performance for more than 20 years have followed this progression. The St. Paul Waterway cap (USEPA 2004) and the Eagle Harbor cap (USACE 2012), constructed in the late 1980s and early 1990s, respectively, required some early maintenance in their first few years (e.g., placement of additional, coarser material in an erosional area on the St. Paul Waterway cap). As documented in USEPA's 5-year review summaries, subsequent monitoring has demonstrated the continued protectiveness of these sediment caps. USEPA's confidence in the 1988 St. Paul Waterway cap was such that USEPA in 1996 ultimately determined that "no further response action was required [because] physical, chemical, and biological sampling has shown that the sediment cap is functioning as planned, and that diverse biological communities are inhabiting the area" (61 FR 44269, 8/28/96) and

delisted the sediment areas of the site from the National Priorities List two months later (61 FR 55751, 10/29/96).

3.5. Capping Is A Remedial Option with Demonstrated Effectiveness at the Site.

Placement of the Armored Cap was a proven technique for reducing both the short- and long-term risk of exposure to contaminated sediments. The Armored Cap has since undergone nearly three years of post-construction monitoring and maintenance that has demonstrated its ongoing protectiveness.

The Armored Cap serves as the basis for constructing the Permanent Cap as part of Alternative 3N. Flattening the slopes of the Armored Cap to create the Permanent Cap would further enhance the structural integrity and long-term reliability of the Armored Cap. The Permanent Cap will provide continued robust isolation and protection of dioxin-impacted materials and therefore an effective remedy for long-term source control, without impacting the flood capacity of the river. It will do so while minimizing short-term impacts to the environment and accelerating risk reduction. In short, the Permanent Cap (Alternative 3N), designed to be protective under a 100-year storm event and a 500-year flood event, will provide the most effective remedial option for the Northern Impoundments.

IP and MIMC retained internationally recognized capping expert, Dr. Danny Reible of Texas Tech University, to peer review the original Armored Cap and its enhancements, as well as their recommendation of Alternative 3N as the preferred remedy for the northern area of the Site. Dr. Reible concluded that "[a]s noted above, I find that the current enhanced armored cap exceeds the Army Corp Subaqueous Cap Guidance (1998) and that the proposed Alternative 3N is even more robust and protective than the existing armored cap. The armored cap should be effective and protective on a long-term basis, as has been the case of numerous other caps installed in this country and worldwide." Dr. Reible's Report is attached to this submittal as Appendix B.

3.6. Immobility of Dioxins Further Enhances The Effectiveness Of The Armored Cap

Concern has been raised about the appropriateness of capping subaqueous dioxins at the Site because of the levels of dioxins found within the Northern Impoundments. However, based both on the general well-known properties of dioxins, as well as the site-specific conditions and data, capping the paper mill waste is an appropriate remedy for this Site, and is consistent with the provisions of the NCP and the Contaminated Sediment Guidance.[9]

Dioxins are characterized by extremely low vapor pressures, high octanol-water and organic carbon partitioning coefficients, and extremely low water solubilities. Thus dioxins have a strong affinity for materials with high organic content, such as the pulp waste associated with the Northern Impoundments. After dioxins are sorbed to PM or bound in an organic phase, they exhibit little potential for leaching or volatilization.

The low solubility of dioxins and furans and affinity for materials with high organic carbon, such as the waste in the Northern Impoundments, combined with the very low measured permeability of the pulp waste at the Northern Impoundments (in the range of 10-6 cm/sec to 10-7 cm/sec), make dissolved

[9] USEPA guidance relies on both toxicity and mobility considerations to determine if materials represent a Principal Threat Waste. Although some of the concentrations of dioxins and furans within the impoundments are high, those materials should not be classified as PTW because they are reliably contained, and as such, do not constitute PTW because of their lack of mobility.

transport of these chemicals from the waste through groundwater or surface water unlikely. The question of mobility is typically one of the issues that is evaluated at contaminated sediment sites, and that was the situation here, where an extensive investigation of the dioxins, was undertaken, including in groundwater and surface sediments, and of particular importance, in the porewater immediately above the armored cap.

Groundwater sampling data from wells completed beneath the Northern Impoundment demonstrated that neither shallow alluvial nor deep groundwater resources have measureable concentrations of dioxins, or other chemicals of concern (COCs). Results of the groundwater study confirmed that there is no pathway potentially leading to exposures to waste-related dioxins from the area of the Northern Impoundments to shallow alluvial groundwater or deep groundwater. Groundwater evaluations in the Southern Area also confirmed that dioxins were not being transported through a groundwater pathway.

The final and perhaps most important line of evidence confirming the immobility of dioxins generally and under site-specific conditions is the Armored Cap porewater and surface water evaluation conducted in May through July, 2012 by Dr. Reible. This investigation showed the dissolved surface water concentrations of 2,3,7,8-TCDD and 2,3,7,8-TCDF were below detectable levels. With regard to porewater concentrations within the Armored Cap, there were no detectable concentrations of 2,3,7,8-TCDD or 2,3,7,8-TCDF in the porewater of the Armored Cap with the exception of one station out of 14 where 2,3,7,8-TCDF was detected, but could only be estimated because it was below the method reporting limit. These results confirm that the general chemical properties of dioxins, the low permeability of the pulp waste and the design and construction of the Armored Cap effectively have eliminated and will continue to effectively eliminate the potential release of dioxins associated with waste materials within the Northern Impoundments.

4. USEPA SHOULD REJECT THE REMAINING ALTERNATIVES (ALTERNATIVES 4N TO 6N) THAT INVOLVE DREDGING RISKS AND REDUCED EFFECTIVENESS

4.1. Construction Risks Inherent in Dredging Reduce the Potential Effectiveness of Stabilization and Removal Options (Alternatives 4N to 6N)

The Sediment Guidance states that there should not be "necessarily a presumption that removal of contaminated sediments from a water body will be necessarily more effective or permanent than capping or MNR." Section 3.4. Consistent with this direction, any perceived benefit resulting from stabilization or permanent removal of impacted material must be considered in the context of the risks that removing the Armored Cap and dredging and excavation of sediments may increase potential harm to human health and ecological receptors due to increased exposure to contaminants resuspended in surface water (USEPA 2005; NRC 2007; Bridges et al. 2008). These risks can remain even with the effective use of BMPs. For example, approximately 2.2 percent of the mass of contaminants dredged were released downstream at the Fox River Deposit 56/57 dredging project (Steuer 2000). In recent years, the effectiveness of silt curtains in controlling releases has been questioned (Bridges et al. 2008).

USEPA's Sediment Guidance provides: "Some contaminant release and transport during dredging is inevitable and should be factored into the alternatives evaluation and planned for in the remedy design." The Guidance goes on to state that "Generally, the project manager should assess all causes of resuspension and realistically predict likely contaminant releases during a dredging operation." (p. 6-22). Table 4.2 of the FS identifies several examples of projects where sediment removal using various dredging techniques resulted in the resuspension of contaminants. At this Site, the risk of releases during dredging is clearly present despite use of BMPs, particularly in the submerged impoundment areas due to

the proposed disruption, destabilization and handling of the existing intact and stable paper pulp material currently located under the enhanced Armored Cap. The risk of releases could be even more significant if a storm event occurs during the up to 19 months of anticipated construction of Alternatives 4N to 6N when the Armored Cap would have been removed and underlying waste materials exposed to the environment. As discussed below, there is a 30 to 40 percent probability that a significant storm or flooding event could occur during the time that the Armored Cap is removed. In contrast, the risk of any releases from the Permanent Cap is extremely remote.

There are also implementation and residual risks associated with dredging operations. Implementation risks associated with dredging remedies may include impacts on the community (e.g., noise, accidents, and residential disruption), construction-related risks to workers during sediment removal, and disruption of the benthic community (USEPA 2005). The residual risks are the following (Patmont and Palermo 2007; Bridges et al. 2008):

- Undisturbed residuals found at the post-dredge sediment surface that have been uncovered, but not fully removed as a result of the dredging operation
- Generated residuals that are dislodged or suspended by the dredging operation and are subsequently redeposited on the bottom either within or adjacent to the dredging footprint.

Such risks are often related to residuals (i.e., contaminated sediments) remaining in the aquatic environment once dredging has been completed (USEPA 2005; NRC 2007; Bridges et al. 2008). Implementation and residual risks are site and remedy-specific and must be considered during remedy evaluation and selection (USEPA 2005). Importantly, a fully protective remedy can be achieved without such risks through implementation of Alternative 3N.

4.2. Dredging Resuspension and Release Case Studies Demonstrate the Risks Associated with Dredging Remedies

Operational and engineering controls (rigid and flexible barriers) are often used to the extent practicable to mitigate potential releases; however, the effectiveness of operational controls has not been documented, and in some attempts, operational controls have actually increased the resuspension of sediments during dredging (USACE 2008b). Case studies have shown that engineering controls used to control impacts from dredging, such as sheetpiles, may have limited effectiveness; are subject to leakage; accumulate resuspended sediments at the base of the walls, which is impossible to completely capture; and have other technical limitations (USACE 2008b; Anchor Environmental 2005; Anchor QEA and Arcadis 2010). Further, rigid barriers can pose unintended consequences such as concentration of dissolved-phase chemicals, localized scour adjacent to the barrier, and the spread of contaminants during their removal (Konechne et al. 2010; Ecology 1995; Anchor QEA and Arcadis 2010). Flexible barriers, such as turbidity curtains, will suffer from losses because these types of barriers are not truly water-tight (USACE 2008b; Anchor Environmental 2005; Francingues and Palermo 2005; Anchor QEA and Arcadis 2010; USACE 2008a).

Case studies have shown that dredging-based cleanup remedies can result in increased fish tissue concentrations of COCs, often for several years following completion of dredging (e.g., at the Commencement Bay and Duwamish Waterway Superfund Sites; Patmont et al., 2013). For example, during the 1995 Non-Time Critical Removal Action (NTCRA) in the Grasse River, caged fish deployed along the perimeter of a set of three silt curtains for 6 weeks showed several-fold increases in

polychlorinated biphenyl (PCB) concentrations compared to those observed in the pre-dredging period (NRC 2007). Lessons learned from the 1995 NTCRA and dredging projects at other sites over 10 additional years did not prevent a similar impact to Grasse River fish during the 2005 Remedial Options Pilot Study dredging (NRC 2007). The PCB concentrations increased substantially in fish during the 2005 dredging pilot (NRC 2007). The increase in fish tissue COC concentrations at the Grasse River and at many other sites as a result of dredging is of serious concern at this Site as well.

4.3. Site-Specific Dredging Risks of Alternatives 4N to 6N Would Reduce the Effectiveness of Each of Those Alternatives

Risks associated with implementation of Alternatives 4N, 5N, 5aN, and 6N include the potential for some resuspension and release of dioxins into the water column outside of the work area. These stabilization and/or dredging-based alternatives would each require the removal of the existing Armored Cap to access the target material. Based on the history of resuspension, releases, and residuals identified by the USEPA, National Academy of Sciences, the USACE, and others, and despite use of BMPs, there is the possibility that some of these risks would occur during implementation of these alternatives at the Site.

4.3.1. There is a Possibility of a Storm Event During Construction That Could Result in Widespread Dispersal of Material

The weather is out of everyone's control, and if a significant storm or flood were to occur during construction of a dredging-based remedy, any controls that may be instituted to control dredging residual releases under normal flow conditions would be overwhelmed. For Alternatives 4N, 5N, 5aN, and 6N, each of which requires removal of all or portions of the Armored Cap during construction, the consequences of flooding could be significant: exposed, disturbed materials would be at risk of spreading beyond the remedial area.

Modeling included with the FS predicts a 30 to 40 percent likelihood that such a flood could occur during construction while the Armored Cap is removed (see FS, Appendix B). The actual risk of such an event – were one of these alternatives to be selected – may be even more significant. These alternatives involve significant implementability risks associated with the need for an off-site staging area, and in the case of Alternatives 5N, 5aN, and 6N, the management of large volumes of excavated materials. The flood event estimates developed for the FS are based on projected construction periods that assume access to an off-site work area in a location that is sufficiently large to efficiently handle the material removed from, and being transported to, the work site. The risk associated with availability of a suitable off-site location is particularly significant for Alternatives 5aN and Alternative 6, because of the volume of material involved under those alternatives. If a suitable property is not available nearby, that would impact the construction period for these alternatives. Any extension of the construction period would increase the likelihood of a flood during construction.

4.3.2. Consistent With Dredging Projects Nationally, Modeling Performed for This Site Demonstrates the Potential for Impacts of Releases and Resuspension Associated with Dredging and Construction Activities in Implementing Alternatives 4N to 6N

The modeling presented in the FS's Appendix A demonstrates the potential short-term water column impacts associated with the stabilization and dredging alternatives. For example, the model simulation of Alternative 6N indicates that for an assumed dredge release rate of 3 percent (based on experience from other dredging projects; see Table 5-2 of the FS), average surface water 2,3,7,8-TCDD concentrations within the USEPA's Preliminary Site Perimeter would be predicted to increase by more than an order-of-

magnitude above ambient conditions during dredging. These releases would also be expected to increase fish tissue concentrations in the early years following remedy implementation and also result in slight increases in surface sediment concentration in surrounding areas (see Appendix A of the FS for additional details).

To minimize the potential for release of impacted sediment during construction, the work area would need to be protected with a turbidity barrier or silt curtain. The remedy would be intended to achieve full protection upon completion of construction; however, the risk of potentially significant releases of dioxins to the surrounding environment during implementation remains despite the vigorous implementation of BMPs, risk which would be unavoidable and would affect the water column, increase sediment concentrations beyond the work area, and potentially increase tissue concentrations of COCs in aquatic receptors (fish and shellfish).

4.3.3. Alternatives 4N to 6N Also Involve Additional Short-Term Environmental Impacts

Alternatives 4N to 6N also will have significantly higher greenhouse gas, PM, and ozone impacts. These result from construction emissions from equipment operating in the work areas (see Table 4-4 of the FS), as well as from equipment required for off-site transportation and disposal of excavated sediments. There is also a higher risk of accidental injury to workers during construction (see Table 4-5 of the FS). These risks are avoidable only by selecting an alternative that avoids the removal in the first place and provides full and adequate protection on-site.

5. ALTERNATIVE 3N IS THE ONLY ALTERNATIVE THAT MEETS CERCLA'S COST-EFFECTIVENESS REQUIREMENT

Pursuant to the USEPA's 1999 guidance, A Guide to Preparing Proposed Plans, Records of Decision, and Other Remedy Selection Documents, "cost-effectiveness is concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs compared to other available options." Moreover, "if the difference in effectiveness is small but the difference in cost is very large, a proportional relationship between the alternatives does not exist" (Preamble to NCP) (55 Fed. Reg. 8728 (3/8/90)). These proportionality requirements were reiterated by USEPA in Section 7-1 "Risk Management Decision Making" of the Sediment Guidance (USEPA 2005) as follows, "A risk management process should be used to select a remedy designed to reduce the key human and ecological risks effectively. Another important risk management function generally is to compare and contrast the costs and benefits of various remedies." (p. 7-1).

Costs for the response action alternatives for the Northern Impoundments range from $9.5 to more than $99 million. Alternatives 1N and 2N have similar costs, primarily related to long-term OMM of the Armored Cap. Alternative 3N has a higher cost than Alternatives 1N and 2N because it also includes construction of the Permanent Cap and the associated OMM, as well as the implementation of measures to protect the cap from vessel traffic.

Costs for Alternatives 4N, 5N, 5aN, and 6N are exponentially higher than for Alternatives 1N, 2N, and 3N. This reflects the challenges of establishing and operating an off-site staging and processing area, removing the Armored Cap (and then for some alternatives, replacing it with a Permanent Cap), in situ treatment or excavation and associated engineering controls, the quantity of materials being addressed, the duration of work, and the high cost of transportation and disposal of dioxin-impacted sediments.

The figure below compares the overall project cost and projected effectiveness for each of the alternatives.

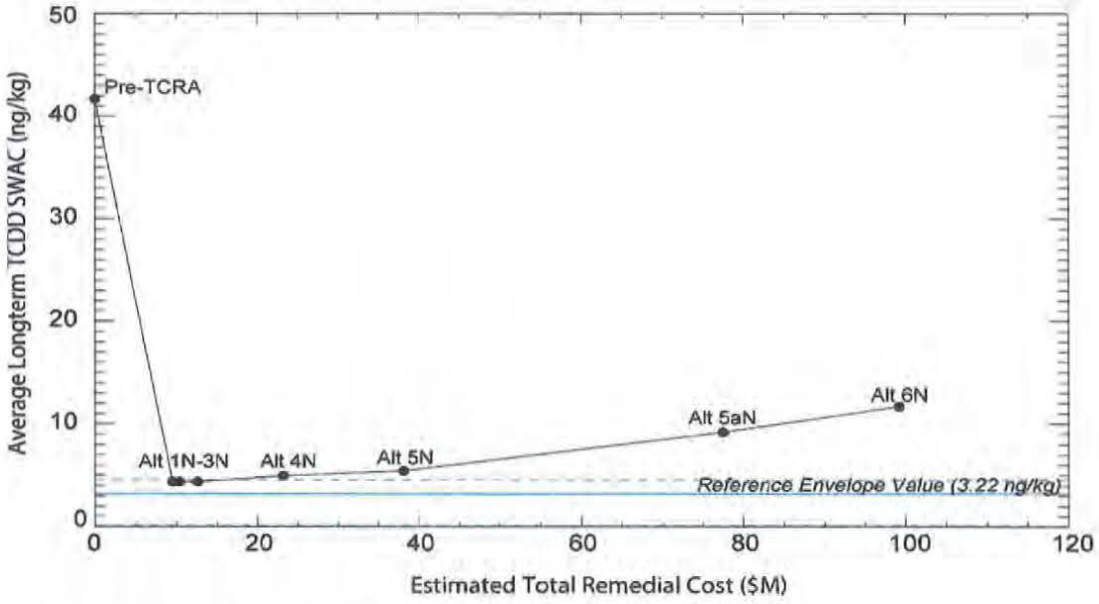

Figure 1 - Overall Project Cost and Effectiveness[10]

Figure 1 demonstrates that Alternatives 1N, 2N, and 3N provide an equal reduction in the surface-weighted average concentration (SWAC) of dioxins in sediments in the river within the USEPA's Preliminary Site Perimeter. Alternatives 4N, 5N, 5aN, and 6N, on the other hand, result in predicted increases in the SWAC for dioxins in river sediments due to dredging-related impacts. While Alternatives 5N, 5aN, and 6N would remove materials with higher dioxin concentrations, they would reduce—rather than increase—the protectiveness of the remedy because of the impacts from construction. These alternatives are also incrementally and substantially more expensive because of their complexity and duration. Further, even assuming that no resuspension, other impacts, or residuals would occur during implementation of Alternative 4N, 5N, 5aN, or 6N (a situation that has not been observed at any environmental dredging project to date), no incremental protectiveness in the SWAC would occur as a result of the implementation of any of these alternatives, yet there would be a substantial and disproportionate increase in cost. Hence, these alternatives would not be considered cost-effective under CERCLA and the NCP because they would not provide additional protectiveness in comparison to the disproportionate incremental cost.

Based on the evaluation of the potential incremental risk reduction as compared to the incremental costs of alternatives for the Northern Impoundments, Alternative 3N clearly is the most cost-effective remedy as defined in the NCP and has the additional advantage of providing a fully protective remedy. The remedy evaluation at this Site should follow the risk management and cost-effectiveness requirements of CERCLA and the NCP by focusing on the alternative with costs that are proportional to the remedy's anticipated effectiveness (risk reduction). Based on the considerations presented in the FS, Alternative

[10] The Reference Envelope Value was calculated as the upper tolerance limit on background concentration data. See Section 4 of the RI Report for further details.

3N is the superior choice. Alternatives 4N, 5N, 5aN and 6N each offer less environmental benefit or reduction in risks, greater uncertainties related to implementation, an extended construction schedule, higher short-term environmental impacts, increased safety risks, higher community impacts, and fail to meet the cost-effectiveness requirement of the NCP. A "compromise" selection of an alternative between 4N and 6N would not be appropriate. Based on site-specific conditions, a removal of the existing cap and some or all of the underlying waste as contemplated in Alternatives 4N-6N would be less protective based on the virtual certainty of creating resuspension and releases of dioxins to the river during construction, followed by long term impacts to sediment and water column concentrations for many years. Such a removal is totally unnecessary to be protective and would be inconsistent with the Sediment Guidance and NCP's 9 criteria, including the criteria of overall protectiveness, implementability and cost-effectiveness, which both require the selected remedy to have proportionality between the risk reduction compared to cost. Thus, applying the principles set forth in CERCLA and the NCP on protectiveness, management of short and long-term risk, risk management and comparative net risk decision-making, and the requirement of cost-effectiveness to ensure proportionality between risk reduction and cost, Alternative 3N clearly stands out as the preferred alternative for the Northern Impoundments.

6. ALTERNATIVE 2S IS THE PREFERRED REMEDY FOR THE SOUTHERN AREA

The RI has demonstrated that any risks from dioxin-impacted soils in the Southern Area are only to a hypothetical construction worker who might contact soil at depths up to ten feet in three specific areas. The shipping industry operations in the vicinity of the Southern Area lend themselves to the implementation of a remedy involving ICs under which property owners would be alerted to the presence at depth of the impacted soil and of the need to take precautions when excavating in specific locations.

Other than No Further Action (Alternative 1S), the remedial alternatives for the Southern Area address both of the CERCLA threshold criteria as established in the NCP: protectiveness and compliance with ARARs. Alternatives 2S and 3S would not require exposing impacted soil or transporting material off-site and would be simpler to implement. Excavation of impacted soil (Alternative 4S) would introduce short-term risks of exposure on-site and potentially off-site should a release occur en route to the disposal facility. While Alternative 4S offers the benefit of permanent removal of impacted soil from the 0- to 10-foot interval, the risk management achieved by ICs is nearly equivalent, particularly with the addition of the physical markers that are part of Alternative 3S. Moreover, the cost of Alternative 4S, $9.93 million, is nearly 15 times the cost of Alternative 3S and nearly 35 times the cost of Alternative 2S. Thus, Alternative 4S does not satisfy the NCP requirement that a remedy be cost-effective, because it does not provide meaningful additional protectiveness in comparison to the disproportionate incremental cost.

Alternatives 2S and 3S effectively mitigate potential risks associated with exposure to soil in the Southern Area with reduced short-term exposure risks and at costs commensurate with the potential risk associated with the impacted soil at depth. Based on the NCP proportionality provisions, Alternative 2S is the highest ranked alternative when applying the NCP's remedy selection criteria [Part 300.430(e)(9)]. Alternative 2S is also the most cost-effective remedy for the Southern Area, in that no material incremental protectiveness would be achieved by excavating subsurface soils that are not posing any present unacceptable risk. While Alternative 4S offers a marginal increase in long-term effectiveness by removing the impacted soil, it does so with an increased short-term risk of exposure and potential traffic accidents.

Applying the principles set forth in CERCLA, and the NCP on protectiveness, management of short and long-term risk, risk management and comparative net risk decision-making, and the requirement of cost-effectiveness to ensure proportionality between risk reduction and cost, Alternative 2S clearly stands out as the preferred alternative for the Southern Area.

7. APPLYING THE NCP'S NINE CRITERIA TO THIS SITE CLEARLY AND UNEQUIVOCALLY IDENTIFIES ALTERNATIVES 3N AND 2S AS THE OPTIMAL REMEDIES

Alternatives 3N and 2S are fully consistent and compliant with the provisions of CERCLA and the NCP, including the "Nine Criteria" contained in the NCP (Section 300.430(e)(9)). Applying the NCP's 9 criteria to the Site-specific conditions results in an obvious choice for the final remedy for each of the two areas of the Site: Alternative 3N for the Northern Impoundments and Alternative 2S for the Southern Area. The analysis of the recommended Alternatives 3N and 2S under the NCP criteria follows below.

7.1. Overall Protection of Human Health and the Environment

Alternative 3N provides optimal protectiveness as compared with the other alternatives for the Northern Impoundments. It strengthens the existing protective Armored Cap by adding additional armor rock and flattening slopes and by creating protection from vessel traffic to create the Permanent Cap. The Permanent Cap is designed to exceed USEPA and USACE design guidance and to withstand a 100-year storm event and a 500-year flood event. In contrast, Alternatives 4N through 6N would require removal of some or all of the Armored Cap in order to either dredge or stabilize the underlying waste deposits. Further, Alternatives 4N to 6N are likely to result in resuspension and releases during construction that would substantially decrease their protectiveness. Moreover, as compared to Alternative 3N, Alternatives 4N through 6N would result in higher risk of worker injury during construction and risks stemming from up to 17,000 trips by trucks and the resulting emissions from those trucks.

Alternative 2S, employing ICs, is also fully protective because the only potential future risk identified in the Southern Area is from disturbance of subsurface soils in three discrete areas. The only exposure scenario would be to hypothetical future construction workers. This risk can be effectively avoided through deed restrictions that provide notice to future purchasers and construction workers.

7.2. Compliance with ARARs

Alternatives 3N and 2S are fully compliant with the ARARs identified for their respective remedial components during their implementation at the Site.

7.3. Long-Term Effectiveness

Alternative 3N will utilize a proven remedial technology, capping, which is specifically endorsed as one of the key remediation methods in the Sediment Guidance (Chapter 5) as well as the USACE capping guidance (USACE 1998). Despite the protectiveness of the existing Armored Cap and its exceedance of the USACE's design guidelines, Alternative 3N will further bolster the strength and protectiveness of the Armored Cap. In contrast, as noted in the Sediment Guidance, "some contaminant release and transport is inevitable during dredging" (such as Alternatives 4N-6N). Water column releases from construction of Alternatives 4N-6N would be significant and further, surface sediment concentrations of TCDD are projected to linger for over 20 years for those alternatives (see FS, Figures 6-2 and 6-3). In fact, post-construction surface sediment concentrations for Alternatives 4N-6N are never predicted to drop below the levels projected for Alternative 3N. In addition, long term monitoring and maintenance of the

Permanent Cap and USEPA's 5-year review process will ensure its long-term effectiveness. Alternative 3N will also include measures to protect the Permanent Cap from vessel traffic.

Alternative 2S also will be effective on a long-term basis because it is based on the existing Site conditions which do not present any unacceptable surface soil issues. ICs involving a permanent deed restriction will provide appropriate notice to current and future owners and correspondingly, to potential future construction workers about the risks potentially present in subsurface soils.

7.4. Reduction of Toxicity, Mobility and Volume through Treatment

Alternative 3N does not provide additional reduction of toxicity, mobility and volume (TMV) due to treatment beyond that achieved during the TCRA. During the TCRA, however, some of the wastes in the "western cell," which were already highly stable, were further stabilized using Portland cement. Risk reduction would be further achieved under Alternative 3N by the construction of the Permanent Cap, the use of ICs and monitoring to verify that clean sediment layers continue to prevent potential exposure pathways at locations outside the Permanent Cap, and by implementing measures to protect the Permanent Cap from vessel traffic. Neither Alternative 2S nor any of the other alternatives for the Southern Area include TMV, because of the nature of the alternatives under consideration.

7.5. Short-Term Effectiveness

For purposes of short-term effectiveness, Alternative 3N is clearly superior to Alternatives 4N through 6N due to the inevitable resuspension, release and residuals risks to the environment during the dredging/excavation component of those remedies (see Sections 6.5.5 [Resuspension and Releases] and 6.5.7 [Residuals] of the Sediment Guidance (USEPA 2005) and USACE 4Rs publication (USACE 2008a)). Worker safety risks, greenhouse gas, PM emissions, and ozone impacts are estimated to be more than 8 to 20 times higher for Alternatives 4N, 5N, 5aN, and 6N compared to Alternative 3N. Traffic and community impacts for Alternatives 4N, 5N, 5aN, and 6N (measured as truck trips) are estimated to range from 6 to 70 times greater than for Alternative 3N. As is shown in Figures 6-1a, 6-1b, 6-2, and 6-3 of the FS, Alternatives 4N, 5N, 5aN, and 6N have potential short-term and long-term impacts due to releases during construction; in contrast, Alternatives 1N, 2N, and 3N do not have similar impacts to sediments and water column concentrations.

With respect to Alternative 2S, there are no short-term effectiveness issues, compared to some minimal short-term risks under Alternative 4S, resulting from potential risks to the community, ecological receptors and workers.

7.6. Implementability

There are very limited potential implementability concerns about Alternative 3N, based on the successful construction of the Armored Cap during the TCRA and the many successful cap installations around the world. In contrast, there would be more challenging implementation issues with Alternatives 4N through 6N as result of the need to stabilize or remove wastes and sediment while working in a floodplain and subtidal areas. In addition, Alternatives 4N through 6N may involve significant challenges relative to locating off-site property at which the excavated waste materials can be managed prior to shipment to an offsite landfill for disposal.

There are no implementability issues with Alternative 2S.

7.7. Cost

Alternative 3N is the most cost-effective alternative. Both CERCLA and the NCP require that remedies be cost-effective. 42 U.S.C. §9621(a); 40 CFR §300.430(f)(1)(ii)(D). Cost-effectiveness is defined as "costs [that] are proportional to [a remedy's] overall effectiveness." *Id.* Alternative 3N effectively and permanently reduces risk in a cost-effective manner (with costs in the $12.5 million range) when compared to the other remedies (which range from $23.2 million to $99 million). The other remedial alternatives do not provide any material incremental risk reduction, and create the potential for additional risk and exposure as a result of impacts to the environment in the form of resuspension, releases, and residuals.

Therefore, based on application of the NCP criteria and Sediment Guidance policies to Site-specific conditions, Alternative 3N is the clear choice to address the Northern Impoundments. Likewise, Alternative 2S is the most cost-effective remedy for the Southern Area, because no material incremental protectiveness would be achieved by excavating subsurface soils that are not posing any present unacceptable risk.

7.7.1. Modifying Criteria

State acceptance and community acceptance have yet to be determined and are not addressed in this analysis.

7.7.2. Conclusion

In conclusion, Alternatives 3N and 2S are the highest ranked alternatives when applying the NCP's remedy selection criteria in Section 300.430(e)(9). For the Northern Impoundments, the TCRA evaluation and design process completed in 2010 by the Respondents and USEPA included a remedial alternatives evaluation. The 2010 TCRA alternatives evaluation considered five different alternatives that involved different variations of capping and removal, and at the end of the process USEPA chose an armored cap as the preferred TCRA alternative in its decision document for the TCRA and required that the cap be designed and constructed to withstand a 100-year flood event. Maintaining and enhancing the TCRA Armored Cap complies with CERCLA and the important policy set out in the NCP that removal actions should be consistent with the final remedy and should to the extent practicable, contribute to the efficient performance of any long-term remedial action. Based on application of the NCP criteria as well as the Sediment Guidance and USACE guidance to Site-specific conditions, Alternative 3N is the clear choice to address the Northern Impoundments and Alternative 2S is the clear choice to address the Southern Area.

APPENDIX B TO JUNE 2014 COMMENTS
(DR. DANNY REIBLE'S REPORT)

Memorandum

4611 102nd St
Lubbock, TX 79424

Date: June 17, 2014

From: Danny D. Reible, PhD, PE

To: *International Paper and McGinnes Industrial Maintenance Corporation*

Re: *San Jacinto River Site – Remedial Review of the Current Cap and Proposed Enhanced Cap*

At the request of International Paper Company (IP) and McGinnes Industrial Maintenance Corporation (MIMC), I have reviewed the following documents relative to the San Jacinto River Site (Site):

1. Anchor QEA, 2011. Final Removal Action Work Plan, Time Critical Removal Action, Prepared for USEPA, Region 6, on behalf of MIMC and IP. November 2010. Revised February 11, 2011.

2. Anchor QEA, 2012. Revised Draft Final Removal Action Completion Report. Prepared for USEPA, Region 6, on behalf of MIMC and IP. March 9, 2012.

3. Anchor QEA, 2012. Time Critical Removal Action Cap Inspection Notification Letter. Prepared for USEPA, Region 6, on behalf of MIMC and IP. July 23, 2012.

4. Anchor QEA, 2012. Post-TCRA Quarterly Inspection Report – July 2012 Inspection. Prepared for USEPA, Region 6, on behalf of MIMC and IP. August 21, 2012.

5. Anchor QEA, 2012. TCRA Maintenance Completion Report. Prepared for USEPA, Region 6, on behalf of MIMC and IP. August 27, 2012.

6. Anchor QEA, 2013. Armored Cap Enhancement Work Plan. Prepared for USEPA, Region 6, on behalf of MIMC and IP. November 27, 2013.

7. Anchor QEA, 2014. Draft Final Interim Feasibility Study Report. Prepared for USEPA, Region 6, on behalf of MIMC and IP. March 21, 2014.

8. Integral and Anchor QEA, 2013. Remedial Investigation Report. Prepared for USEPA, Region 6, on behalf of MIMC and IP. May 17, 2013.

9. USACE, 2013. Review of Design, Construction and Repair of TCRA Armoring for the West Berm of San Jacinto Waste Pits. Prepared for USEPA, Region 6. USACE Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, Mississippi, 39180-6199. October 2013.

Reviewer's Background and Experience

The basis for my review is approximately 30 years of experience with contaminated sediments and particularly management via in-situ remedial approaches. In 2005, I was elected to the National Academy of Engineering for "developing widely used approaches for managing contaminated sediments". Much of my work in contaminated sediments has been associated with the assessment, design and implementation of capping. I am a co-author of the standard guidance for capping contaminated sediments (Palermo et al. 1998) and in 2004 I led the first demonstration of amended or active capping in the field (Reible et al. 2006). I have coauthored several National Research Council reports that have guided the management of contaminated sediments including "A Risk Management Strategy for PCB-Contaminated Sediments" (2001),"Environmental Cleanup at Navy Facilities: Adaptive Site Management" (2003), "Assessing the Effectiveness of Dredging at Superfund Megasites" (2007). I also have peer reviewed many facets of capping projects, including at the design, construction and post-construction monitoring phases for government agencies and private parties.

Cap Design and Maintenance

The cap at the Site is armored to contain contaminated solids, a design that is appropriate for solid-associated contaminants. The permanence and protectiveness of such a cap is associated with its ability to withstand erosive forces and events.

The armored cap, completed in 2011, incorporates armor stone, geotextile and geomembrane layers over approximately 15.7 acres. It was designed in accordance with USACE guidance to withstand a 100-year storm event with an additional factor of safety to ensure its long-term effectiveness.

In July 2012, an inspection of the cap showed some movement of armor material as a result of the erosive action of a flow event. The reports on this event indicate that the area of the armor movement was limited to 200 square feet of the northern berm and represented approximately only 0.03 percent of the overall cap. Neither the underlying geotextile, nor the waste material underneath the armor layer was disturbed. In this case, the underlying waste material was not exposed due to the presence of geotextiles that would retain the waste, even if localized loss of armor stone were to occur.

The movement of the armor material during the event led to maintenance to restore appropriate cap slopes and armor material at the surface of the cap. Maintenance of a cap is sometimes required to address conditions in localized areas based on site-specific flow conditions that sometimes vary across specific areas of a constructed cap. In response to the armor rock movement, armor rock from an Armor Cap C stockpile (located in the vicinity of the Site as required by the EPA-approved Operations, Monitoring and Maintenance Plan for the cap) was placed in the area of the movement with no greater than a 1:2 slope to ensure stability of the repaired cap.

Cap Review

A review of the cap armoring design and the maintenance efforts was conducted in 2013 by Dr. Paul Schroeder of the USACE. Dr. Schroeder, of USACE's Engineer Research & Development Center, is one of the leading experts on in-situ caps and is one of the lead authors of the anticipated 2014 USACE update of the 1998 USACE Subaqueous Capping Guidance. Dr. Schroeder noted some concerns about the original design and construction that may have contributed to the partial loss of armor material in 2012, He noted the need for the design to consider wave runup and overtopping and the need to ensure appropriate uniformity and limited slope of the placed material. Dr. Schroeder recommended reducing slopes in areas potentially subject to runup and overtopping to no greater than 1:3 while ensuring uniformity of the placed Armor Cap C material.

The January 2014 Enhanced Armored Cap

Following completion of a post-construction engineering review conducted by IP and MIMC and in response to Dr. Schroeder's evaluation, the armored cap was enhanced in January 2014, utilizing larger-sized stones and flattening the grade of the slopes of the cap as follows:

- Placement of larger Armor Rock D. Armor Rock D has a D_{50} of 10 inches compared to a D_{50} of Armor Rock C of 6 inches and a uniformity coefficient of 1.55. Use of Armor Rock D satisfied Dr. Schroeder's concerns about uniformity and provided greater conservatism in the armor rock sizing.
- Ensuring all slopes post-construction will exhibit a slope no greater than 1:3. This satisfied Dr. Schroeder's concerns about slope in some areas which could be potentially subject to runup and overtopping.

These measures resulted in a cap that exceeds the design criteria in the USACE 1998 Subaqueous Capping Guidance. In addition, the enhanced cap exceeds the recommendations of Dr. Schroeder and will effectively ensure long-term stability of the armor stone. The modifications meet the original design criteria of cap stability in a 100 year storm and 500 year flood over the entire cap. In addition, the cap continues to include underlying geotextile and geomembrane layers as additional containment layers. The resulting enhanced armored cap is robust and is not expected to be subject to significant movement, thinning or loss as a result of hydraulic forces as noted above.

As part of my review of the existing and proposed cap enhancements, I also considered the question of potential chemical mobility of the capped dioxins and furans at the Site. Dioxins and furans are organic chemicals that are strongly solid-associated and largely immobile due to their chemical structures. Dioxins and furans have a strong affinity for materials with high organic content, which is the case with the pulp waste present at this Site. Once dioxins and furans sorb onto particulate matter or are bound in an organic phase, they exhibit little potential for leaching or volatilization. At this Site, the very low measured permeability of the pulp waste at the northern impoundments (in the range of 10-6 cm/sec to 10-7 cm/sec) and the design and construction of the armored cap effectively have effectively eliminated and will continue to effectively eliminate the potential release of dioxins

associated with the waste materials in the northern impoundment. The groundwater sampling data from wells completed beneath the northern impoundments demonstrated that neither shallow alluvial nor deep groundwater resources have measureable concentrations of dioxins and furans, or other chemicals of potential concern. Results of the groundwater study confirmed that there is no pathway potentially leading to exposures to waste-related dioxins and furans from the area of the northern impoundments to shallow alluvial groundwater or deep groundwater.

In June 2012, I was asked to conduct porewater sampling at the Site of armored cap porewater and surface water. My investigation showed the dissolved surface water concentrations of 2,3,7,8-TCDD and 2,3,7,8-TCDF were below detectable levels in the sampling medium. In addition, there were no detectable concentrations of 2,3,7,8-TCDD or 2,3,7,8-TCDF in the porewater of the armored cap with the exception of one station out of 14 where 2,3,7,8-TCDF was detected, but could only be estimated because it was below the method reporting limit. Consistent with the general chemical properties of dioxins and furans, the capped pulp waste at this Site should not be considered mobile. As such, the existing cap should be effective on a long-term basis, and the proposed Alternative 3N cap will provide even greater protectiveness.

Review of Proposed Alternative 3N

As part of my peer review, I also examined Alternative 3N, which I understand has been proposed by IP and MIMC. Alternative 3N would further strengthen the existing armored cap beyond the substantial enhancements completed in January 2014, by adding more armoring, flattening the slopes and implementing additional measures to provide protection against potential issues (groundings) from vessel traffic. These additional measures should serve to provide an even more robust cap and will improve the long term effectiveness of the cap beyond that of the already protective armored cap as strengthened and enhanced in January 2014.

Conclusion

I completed a review of the history of the design, construction and maintenance of the original cap and enhancements to it at the San Jacinto River site, as well as the proposed further enhanced Alternative 3N cap, which has been proposed to serve as the final remedy for the northern area of the Site. As noted above, I find that the current enhanced armored cap exceeds USACE Subaqueous Cap Guidance (1998) and supplemental comments by Dr. Schroeder and that the proposed Alternative 3N is even more robust and protective than the existing armored cap. The armored cap should be effective and protective on a long-term basis, as has been the case of numerous other caps installed in this country and worldwide. As with any remedy, post-construction monitoring should continue to be required to ensure that construction meets design performance.

Executive Summary

Numerous tasks were performed to assess the remediation alternatives presented in the Feasibility Study, as well as to identify any other remedial action alternatives, technologies or BMPs that may be appropriate for the Site. In addition, the technical evaluation included a) an assessment of hydraulic conditions in and around the San Jacinto River, b) an evaluation of the numerical models used by the PRPs for the Site, and c) use of surface water hydrologic, hydrodynamic, and sediment transport models appropriate for the Site in performing the assessment. Tasks 2, 3, 5, 7, 8, 9 and 10 addressed the permanence of the capping Alternative 3N. Tasks 4, 6, 11, 16, 17 and 19 addressed the effectiveness of the capping Alternative 3N. Tasks 16 and 17 also addressed the effectiveness of dredging Alternative 6N (including the components of Alternatives 4N, 5N, and 5aN). Tasks 11, 12, 13, 14, 15 and 18 addressed the short-term impacts of remediation, particularly by dredging. Finally, Task 20 provided a review of the clean-up level.

Permanence of Capping

The evaluations performed to address the permanence of the existing repaired TCRA cap with the proposed modifications outlined in the capping Alternative 3N showed that the cap is expected to be stable and permanent, requiring only maintenance or repair following unusual catastrophic events. The expected losses from such events would be expected to be small, comparable or smaller than losses from removal of the contaminated sediment as predicted for dredging Alternative 6N.

Tasks 2, 3, and 7 showed that the armored cap is predicted to have long- term reliability from scour related processes. Task 5 showed that the slope improvements proposed in Alternative 3N provides the recommended factor of safety for slope stability if well constructed. Task 8 showed a low probability of barge strikes that would impact the integrity of the cap. Additionally, Task 8 showed that if the cap were impacted, the potential losses of contaminated sediment would be much smaller than the losses from the complete removal Alternative 6N. Task 9 identified institutional and engineering controls to ensure permanence by controlling activities at

the site. Task 10 showed that reliability has been routinely achieved at other armored sites and facilities.

Effectiveness of Capping

The evaluations performed to address the effectiveness of the existing repaired TCRA cap with the proposed modifications outlined in the capping Alternative 3N showed that the cap is expected to be highly effective in controlling the flux of contaminants and reducing the exposure concentration of contaminants in the water column. The exposures and flux at the site will be overwhelmingly dominated by the area left to be remediated by monitored natural recovery. The quality and quantity of deposition that occurs in the future will greatly influence the overall recovery of the site.

Task 19 estimated that the net sedimentation rate (NSR) at the site is 1.3 cm/yr ± 0.8 cm/yr. Even this modest predicted net sedimentation rate on the cap is predicted to maintain the cap's effectiveness. Task 6 confirmed that the primary requirement of the cap is to control the resuspension of sediment particulates, which requires a filter between the sediment and armor cap material. A geomembrane or geotextile filter is present in all areas except in the deeper waters where a blended filter media was incorporated with the armor cap material as in the Northwestern Area. The blended filter and cap construction in the more steeply sloped areas should be examined for adequacy (*i.e.*, presence and thickness) and integrity (*i.e.*, no separation or grading of sediment particle sizes during construction) to provide isolation of the sediment from bioturbators. Tasks 11 and 16 showed the expected resuspension and releases from capping are very small compared with removal activities. Task 17 showed that the cap effectively controls bioaccumulation.

Effectiveness of Dredging

The effectiveness of removal activities rely on residuals management through either excavation in the dry or capping/covering/backfilling. Task 16 showed that best construction practices for residuals management are needed for removal alternatives to achieve the same level of effectiveness as capping alternatives, based on predictions of the long-term contaminant flux and bioavailable contaminant concentrations in the bioactive zone. Task 16 showed the long-term releases from various

removal activities with alternative residuals management practices. Task 17 showed that the removal can effectively control bioaccumulation.

Impacts of Remediation

The short-term impacts of remediation activities are primarily related to resuspension of sediment, erosion of residuals, and the concurrent release of contaminants. Enhancement of the TCRA cap under Alternative 3N would be expected to produce very little impacts, while Task 14 showed that full removal

under Alternative 6N would be expected to significantly increase short-term exposures to contaminants.

Tasks 11 and 12 predicted and compared the short-term losses of solids and contaminants for the various removal alternatives. The losses represent a significant increase in exposure (more than an order of magnitude). Fish tissue contaminant concentrations would be expected to be several times greater than existing concentrations for several years before returning to pre-remediation values. Upon comparison with Task 16 long-term post-remediation predictions, the short-term losses are comparable to the expected losses across the entire site over the 500 years following remediation, and more than 100 times the predicted losses from an intact cap over the 500 years following placement. Tasks 14 and 16 showed that the short-term losses will be completely dispersed throughout the site or transported downstream, and the site would largely recover from the losses in a decade. Task 18 showed that, depending on the selection of BMPs, flooding and high flow conditions during removal operations would significantly increase the erosion of sediment residuals. Depending on the BMPs used and the quantity of sediment and residuals exposed at the time of the high flow event, Task 18 found that increased erosion would result in sediment and contaminant losses that are several times greater than that predicted in Task 14 without the high flow event.

Clean-Up Level

The clean-up level or sediment remediation action level defines the area and volume of sediment to be actively remediated. The level is established based on the resulting risk for an appropriate exposure scenario. The lower the level is set, the greater the area and volume of contaminated sediment that will be actively remediated, and the lesser the area will rely on monitored natural recovery. Actively remediated areas have resulting exposures that yield risks well below the remediation action objectives and

greatly reduce the overall site risk. Task 20 examined the Child Recreational Fisher exposure scenario applying site data for sediment and tissue concentrations and literature values for uptake and computed a sediment remediation action level of 114 ng/kg sediment $TEQ_{DF,M}$ for 25% site fish consumption, roughly one half of the proposed 220 ng/kg site sediment remediation action level. This lower action level would have only a small effect on the area and volume to be remediated.

APPENDIX C TO SUPPLEMENTAL COMMENTS OF IP AND MIMC[1]

Below are comments regarding the remedial approach at the seven sediment sites reviewed in the Garland Report. The Respondents' contractor, Anchor QEA, has been directly involved in a number of those sites. More specifically:

- Anchor QEA was the author of the Corrective Action Study Report for the Bayou d'Inde site, is designing the remedy for Bayou d'Inde Area A, and provided construction oversight during remedial construction in Bayou d'Inde Area B.
- The McCormick and Baxter Site is located within the Lower Willamette River Superfund Site, at which Anchor QEA was the author of the Draft Feasibility Study.
- At the Pacific Sound Resources Site, Anchor QEA provided cap monitoring services for the US Army Corps of Engineers.
- Anchor QEA staff designed the West Harbor Operable Unit remedy for the Eagle Harbor site.

The comments below are based on Anchor QEA's experience at the four sites listed above and its experience at numerous other sediment sites in Region 6 and nationally. Significantly, none of these sites involved the de-construction of an already existing Armored Cap as would have to occur in order to implement the removal alternatives at this Site.

- **Bayou Verdine, Lake Charles, LA, USEPA Region 6**: At the Bayou Verdine site, the rejection of a capping remedy can be attributed to two factors not present at the Site. First, sediments at Bayou Verdine contain free-phase ethylene dichloride (EDC), which is a highly mobile source material for which capping may not be effective. Second, the ability to implement a capping alternative was assumed to be limited by site access. Installation of the cap was assumed to require a helicopter, which lead to uncertainty about whether the full cap thickness could be placed in all locations within the cap (USEPA, 2003). Similar sediment chemistry and access constraints do not exist at the Northern Impoundments, so the Bayou Verdine Site is not comparable to the Northern Impoundments from the perspective of remedy selection.

- **Bayou d'Inde, Lake Charles, LA, USEPA Region 6**: At the Bayou d'Inde site, remedies were selected for four Areas of Interest (AOIs). Capping was selected as a remedy in AOI-1 and thin cover was selected as the remedy in AOI-3 (LDEQ, 2011, Section 5). In the area in which thin cover was selected as the remedy (AOI-3), several hundred acres of low water areas have been covered with clean sediment as opposed to excavated. *Id.*

  In AOI-2, sediment removal was selected over capping, but the reason that capping was not considered appropriate as a stand-alone option was due to the fact that "any further reduction in water depth by capping materials may impede commercial barge traffic and restrict drainage in this portion of Bayou d'Inde." (Bayou d'Inde Group, 2009, Section 3.2). Dredged material that was removed from AOI-2 was placed under a protective cover constructed in the adjacent marsh. That marsh represented an environment similar to that in and around the Northern Impoundments in that it includes shallow water adjacent to active shipping channels in the Calcasieu River and in Bayou d'Inde.

- **Atlantic Wood Industries, Portsmouth, VA, USEPA Region 3**: Capping was evaluated as a potential option for sediments at this site. Compared to removal, capping ranked lower than

[1] Capitalized terms used in this attachment and not specifically defined have the same meaning as in the supplemental submission to which it is attached.

dredging for "Long-term Effectiveness and Permanence," in part because of the presence of dissolved non-aqueous phase liquids (DNAPL) and the potential for future navigational dredging activity within the proposed cap footprint (UESPA 2007). Neither the presence of DNAPL nor navigational constraints are relevant to selection of a remedy for the Northern Impoundments. Therefore, from the perspective of remedy selection, the decision to reject capping as a remedial alternative at the Atlantic Wood Industries Site is not relevant in evaluating whether capping is an appropriate remedy for the Northern Impoundments.

- **McCormick and Baxter, Portland, OR, USEPA Region 10**: Capping was the selected remedy for sediments at this site. Five years of post-construction monitoring and subsequent investigations have demonstrated that the sediment cap remedy is performing as designed to meet the remedial action objectives required by the ROD (DEQ, 2016). The selection of a capping remedy at this site demonstrates that sediments do not need to be removed for a remedy to be considered protective.

- **Pacific Sound Resources, Seattle, WA, USEPA Region 10**: The selected remedy for this site entailed both dredging and capping. Dredging was selected "…because of the need to maintain navigational access, a cap cannot be constructed in the area of Crowley Marine services without first removing materials through dredging." (URS Group Inc., 2003). Dredging was required in another area "to accommodate the former Longfellow Creek outfall extension located on the southwest shoreline." Thus, the selection of capping at a portion of this site was driven by access and development issues, not by concerns about the protectiveness of capping. There is no similar need to accommodate outfalls and future navigation within the footprint of the Northern Impoundments that would provide the basis for selecting a dredging remedy over a capping remedy for the Northern Impoundments.

- **Welch Creek, Plymouth, NC, USEPA Region 4**: The Garland Report describes the selected remedy for the Welch Creek Site as a "thin cover." The remedy decision for this site demonstrates that sediments do not need to be removed for the remedy to be considered protective.

- **Eagle Harbor, Seattle, WA, USEPA Region 10**: According to the Garland Report, dredging for this project entailed removal of a 54-acre "hot spot." Garland Report at page 14 (Section 5.6). In fact, the area of the site that was 54-acres was the East Harbor Operable Unit (EHOU). The EHOU was addressed through capping with a remedy that involved placement of 275,000 cubic yards (cy) of clean navigational dredged sediment sourced from a nearby location to contain PAH-impacted sediments. Subsequent to construction of the initial cap in 1993 and 1994, capping material was placed over an additional 15 acres in 2000, and in 2002, 50,000 cy of clean material was placed to create intertidal habitat (HDR 2012). No hotspot dredging occurred in the EHOU.

  In another operable unit at the site (the West Harbor Operable Unit [WHOU]), limited hotspot dredging (2,350 cy) was conducted. This dredging was limited to a very small area with high concentrations of mercury with capping or thin-layer cover selected for other locations of the WHOU. In selecting the remedy for the WHOU, EPA considered a broad range of factors.

When evaluating dredging versus capping sediment remedies, there are many different site-specific factors considered by USEPA; chemical concentration (the central focus of the Garland Report) is only one such factor. USEPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA 2005) details the range of factors that are considered for remedy selection, and concludes "The

focus of remedy selection should be on selecting the alternative best representing the overall risk reduction strategy for the site according to the NCP nine remedy selection criteria." (Id. at Section 7.7). USEPA's guidance further notes that "…project managers should evaluate each of the three potential remedy approaches (i.e., MNR, in-situ capping, and removal through dredging or excavation) at every sediment site…to implement a cost-effective remedy that will achieve long-term protection while minimizing short –term impacts."

As demonstrated in the FS for this Site, capping is clearly a more cost-effective remedy than any of the removal remedial alternatives at the Site and satisfies the nine NCP remedy selection criteria.

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